

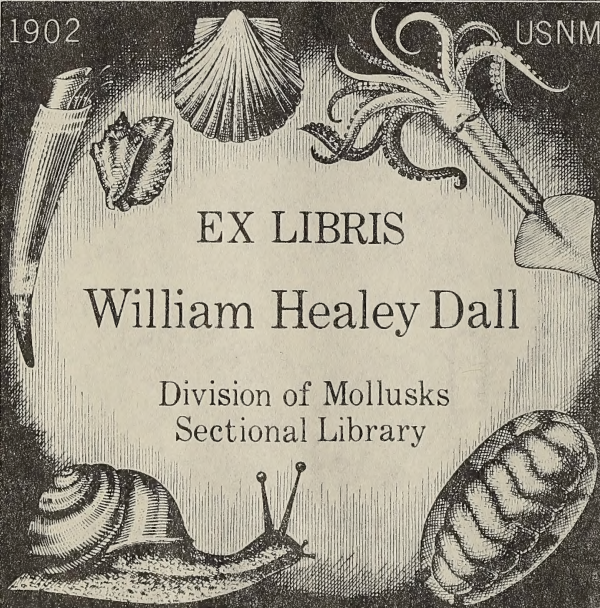
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**MONOGRAPH OF THE
LAND AND FRESHWATER MOLLUSCA
OF THE BRITISH ISLES.**

BIBLIOGRAPHY OF THIS VOLUME.

- Part XII. pp. 1—16, published June 15, 1906.
- Part XIII. }
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- Part XV. pp. 65—144, and plates 2, 7, 8, 9, 10, published Oct. 3, 1908.
- Part XVI. pp. 145—224, and plates 6, 11, 12, 13, 14, published Sept. 30, 1909.
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- Part XVIII. pp. 305—368, and plates 23, 24, 25, 27, 29, published June 17, 1911.
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MONOGRAPH
OF THE
LAND & FRESHWATER
MOLLUSCA
OF THE
BRITISH ISLES.

BY
JOHN W. TAYLOR,

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LATE EDITOR OF THE "JOURNAL OF CONCHOLOGY," ETC. ;

WITH THE ASSISTANCE OF
W. DENISON ROEBUCK, F.L.S., THE LATE CHARLES ASHFORD,
AND OTHER WELL-KNOWN CONCHOLOGISTS.

ZONITIDÆ.

ENDODONTIDÆ.

HELICIDÆ.

LEEDS :
TAYLOR BROTHERS, PUBLISHERS.

1914.

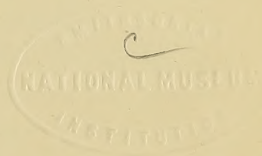




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PREFACE.



THE completion of another volume, dealing with the *Zonitidae*, *Endodontidae* and *Helicidae*, is to me a matter of much satisfaction, and although its preparation has occupied a considerable time, this has unfortunately been unavoidable, as other and inexorable duties interfered for a period with my active prosecution of the work, and as I

still am entirely dependent on my own personal skill and diligence for the whole of the artistic, scientific, and literary work involved in the production of the Monograph, a temporary cessation of publication was inevitable, as no person was available to fulfil my task who possessed the necessary leisure combined with the indispensable scientific attainments and artistic skill requisite for the maintenance of the standard of excellence desired and hitherto maintained.

The exacting nature of these duties is demonstrated by the fact that for the production of the present volume I have had to prepare five hundred pages of text, in addition to compiling the Index, and performing all the other onerous yet necessary literary labour involved; the illustrations in the text, upwards of eight hundred in number, showing the structural and other details of shell and animal, were nearly all drawn and painted by myself, many of them being original and never previously published; the preparation of the forty-eight coloured and other maps, graphically illustrating the British distribution, as well as the complete range of each species, with the consideration and decision upon the many doubtful points involved also occupied a considerable time; while the painting of the more than two hundred original water-colour drawings depicting in natural colours selected examples of the various species treated of, occupied much of my available leisure, which was further encroached upon by the incessant supervision necessary to ensure their faithful reproduction and by the insistent demands of an extensive and at times very harassing correspondence.

To endeavour, therefore, to expedite the completion of the work, it is proposed in future to treat each species, wherever possible, much more succinctly than heretofore, more especially in regard to the lists of fully detailed localities, as the time necessarily consumed in the compilation, comparison, and co-ordination of the enormous numbers of registered occurrences of the various species is very great, and considerable time and space will be saved by these details being more briefly summarized.

It is further very gratifying to find that the truth of the principles governing the Distribution of Life propounded in the present work, and firmly based on organic structure, continues to be increasingly supported by the additional knowledge acquired; while the especial suitability of the land mollusca for revealing the routes of dispersal from the primary evolutionary area was emphatically proclaimed by the late Karl Semper, who after many years' examination and study of many hundreds of species was led more and more strongly to the conviction that a knowledge of the affinities of the land mollusca would probably enable the paths of their dispersion to be determined.

The co-operation and help which I have received in the past from so many well-wishers has been continued during the preparation of the present volume, and I again recall with grateful appreciation the immense help I still continue to derive from the results of the unwearied and unselfish labours of the late Mr. CHARLES ASHFORD, who for so long a period devoted himself to a study of the anatomy of our British mollusks for the benefit of the present work.

Mr. W. DENISON ROEBUCK has continued in numberless ways his valued and helpful assistance, but more especially in the oversight of the innumerable details involved in the allocation of the multitudinous localities to their correct comital or vice-comital districts, for which his official position as Hon. Recorder to the Conchological Society is a special qualification.

Mr. W. BAGSHAW, of Birkenshaw, has rendered me great service by his excellent micro-photographs of the teeth, jaws, and other minute details of the structure of the shells and their animal inhabitants.

The REV. PROF. H. M. GWATKIN has given invaluable assistance by specially preparing the mandibles of any desired species, and also by granting me the privilege of the use of his unrivalled collection of radulae.

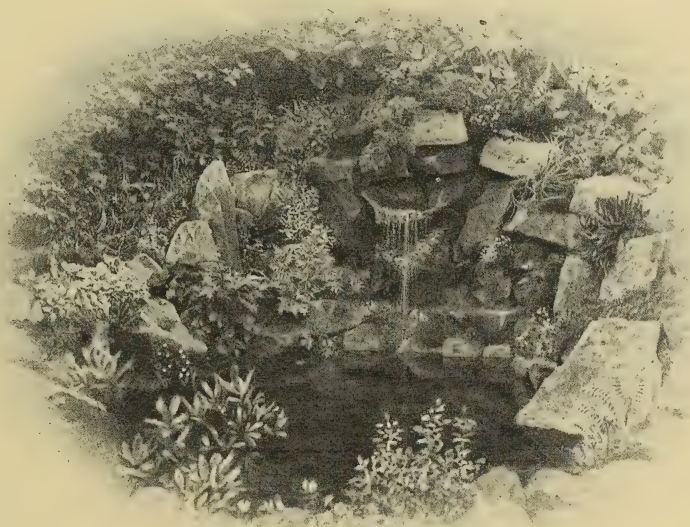
Mr. J. DAVY DEAN has also given me much appreciated help by his exquisite coloured drawings of living *Hyalinæ*, and by his expert advice on the better representation of the shells of other groups.

Mr. F. BOOTH, Mr. C. OLDHAM, Mr. WM. EVANS, and others far too numerous to individually particularise, have rendered great and continuous services which have been from time to time acknowledged in their appropriate places and for which I here again express my indebtedness, while to others, as Mr. F. H. SIKES and Mr. J. F. MUSHAM, I am under exceptional obligations for their disinterested efforts to increase our knowledge of the range of various species by voluntarily undertaking special journeys and investigations into certain neglected portions of Europe and to some of the more remote and less-known islands and districts of our own country.

Trusting that the present volume—the product of long and serious study, close and anxious research, and almost incessant application—will deserve and receive a continuance of that cordial appreciation, bestowed so unstintingly upon the previous volumes, and that the sympathetic encouragement and practical aid received in the past be continued in the future even more generally than heretofore.

JOHN W. TAYLOR.

NORTH GRANGE, HORSFORTH,
LEEDS, *Nov. 23rd, 1914.*



EXPLANATION
OF THE
TERMS, SIGNS, AND METHODS OF RECORD
USED IN THE PRESENT WORK.

! The exclamation mark is used in accordance with an accepted custom, as a mark or token of verification, and indicates that the specimens from the locality or district mentioned have been seen and verified by the author.

RECORDS in which a date is given immediately AFTER the name of the locality signifies that the specimens were collected at that time.

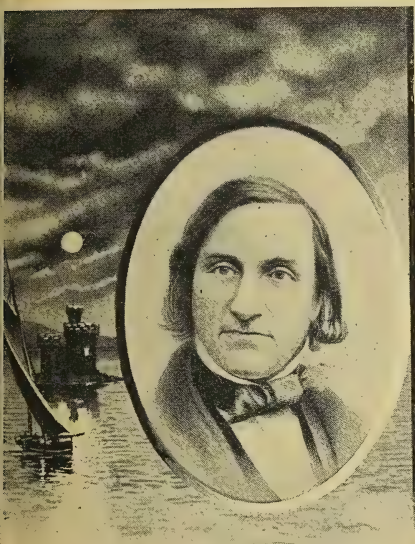
RECORDS in which the date does NOT PRECEDE but follows the name of the collector signifies only the date when the specimens were examined, and that no precise record has been kept of the date when the specimens were collected.

The names of authors when placed within parentheses and following the names of species implies that the generic name used is not the same as that used by the original describer; when the parentheses are not used the species retains its original allocation.

All RECORDS and observations under each species are almost invariably used only in association with the particular name used by the author whose information is being made use of. This mode of treatment is desirable, as though giving all information in its appropriate position, it yet preserves the connection with the name to which it belongs, so that if the reference to the particular species be objected to, the information can be extracted, as it is not confused with other records.

A
MONOGRAPH
OF THE
LAND AND FRESHWATER MOLLUSCA
OF THE
BRITISH ISLES.

PHYLUM MOLLUSCA Cuvier.
CLASS GASTROPODA Cuvier.
SUB-CLASS ANISOPLEURA Lankester.
ORDER EUTHYNEURA Lankester.
SUB-ORDER STYLOMMATOPHORA A. Schmidt.
FAMILY ZONITIDÆ.



Edward Forbes

as of numerous important and valuable essays on geological, conchological, and botanical subjects.

He was also the first to satisfactorily group the various diverse members of our flora and fauna on a comprehensive and scientific plan according to their geographical distribution and assumed origin, promulgating a theory explanatory of their presence in this country, which was formerly almost universally accepted by scientists, and even at the present day has still many ardent adherents,

THE family *Zonitidæ* (Ζωνίτις, possessing a girdle) embraces the groups *Zonites*, *Hyalinia*, *Euconulus*, *Gastrodonta*, *Zonitoides*, *Vitrina*, and other genera, and is characterized by possessing a simple aperture to the semi-transparent spirally-coiled shell; the animal has the foot-margin defined by a pedal groove, which may form a caudal mucus-gland. The marginal teeth are aculeate; the jaw is oxygnathous, and the ovotestis is usually imbedded in the liver.

The primitive *Zonitidæ* are the progenitors of the *Limacidæ* and other pulmonata, and are amongst the most ancient known fossils, although the *Zonites priscus* of Carpenter, reported from the coal measures of Nova Scotia, is more probably referable to the *Endodontidæ*.

This group, the first of the truly testaceous species to be treated upon, is dedicated to the late Prof. Edward Forbes, joint-author with Sylvanus Hanley of the celebrated and classic work "A History of British Mollusca and their Shells," as well

GENUS *VITRINA* Draparnaud.

(*Vitrinus*, Montfort; *Cobresia*, Hübner; *Hyalina*, Studer; *Limacina*, Hartmann; *Helicolimax*, Férussac; *Semilimax*, Férussac; *Pagana*, Gistel).



Spiridon Brusina

HISTORY.—*Vitrina* (*vitrum*, glass) was first satisfactorily differentiated and named by Draparnaud, in 1801, and its members have since been subdivided into several sections by later authors under the names of *Semilimax* Stabile, *Chlamydea* Westerlund, *Phenacolimax* Stabile, *Oligolimax* Fischer, etc.

A family *Vitrinidæ* is not adopted, as tending to unduly enhance the importance of the small group of species which should rightfully be referred to it. As usually employed, the family *Vitrinidæ* embraces a somewhat heterogeneous assemblage of genera, whose only point of resemblance is that the constituent species are passing through a similar stage of shell deterioration, and therefore exhibit externally a superficial similarity to each other, though far removed in structural characters.

Our British species is referable to the group *Phenacolimax*, while *V. diaphana* which represents the section *Semilimax*, is said by Dr. Jeffreys to have been found in the Upper Tertiary strata of

this country, but this record is inherently improbable, and is more likely to be a result of an error of identification.

The genus *Vitrina* is associated with the gifted conchologist and palæontologist, Prof. Spiridon Brusina, Chancellor of the University of Agram, Croatia, whose numerous and esteemed works have contributed so largely to the elucidation of the conchology of South-eastern Europe.

Generic Characteristics.—**EXTERNALLY**, *Vitrina* has an elongate BODY, capable of a more or less complete retraction within the shell; on the dorsal surface there is a rudimentary SHIELD, upon which are found the pallial grooves so characteristic of *Milax*, the shield also partially envelops the shell and is prolonged laterally as a spatuliform lobe; the foot is rather narrow and indistinctly tripartite; **RESPIRATORY ORIFICE** on the right-side of the body and on the margin of the shield; **REPRODUCTIVE ORIFICE** also dextral, but placed near the middle of the neck.

The SHELL, which in this group is undergoing a process of degeneration leading towards its eventual loss, is more or less imperforate, paucispiral, sub-globular in shape, very thin and pellucid, aperture auriform and ample, lip thin and sharp, but with the lower margin becoming broadly and simply membranous in the more advanced species inhabiting the active evolutionary area of Europe.

INTERNALLY, the MANDIBLE or jaw is oxygnathous, closely resembling that of the *Limacidae*; the dentition also displays the same affinity by the presence of the numerous aculeate marginals; the REPRODUCTIVE ORGANS in some species show the glandular pad upon the FREE-OVIDUCT, which is so characteristic a feature of the *Hyalinæ*, while the SUPRA-PEDAL GLAND is well developed and compact and occupies about one-third the length of the foot.

The species of this genus in external characters are intermediate between the slug and the snail, having the external spirally-coiled shell of the latter and the dorsal shield of the former group; they are also closely allied *inter se* and difficult to separate into the various recognized species without the aid of their internal organization, which shows far greater differentiation than the outside form; thus the *Vitrina elongata* possesses a hollow chitinous dart which acts also as the excretory duct of an internal gland, and while, therefore, probably analogous to the Helicine dart, is not its homologue, though Simroth is inclined to think otherwise. *Vitrina brevis* is furnished with a fleshy papilla or sarcobelum, which has also a glandular connection, while many of the tropical *Zonitidae* show affinity in this direction by possessing similar glands and perforate chitinous darts, which are sometimes impregnated with lime.

Food and Habits.—The *Vitrinæ* are truly omnivorous, and even predaceous, bold, active, and very hardy, and apparently quite indifferent to cold, as they have been frequently observed crawling over the snow even during keen frost; they frequent by preference moist and shady places, and are nocturnal or crepuscular in habit, usually coming forth at dusk from their hiding places, to which they again resort before daybreak. The late Hugh Cuming has recorded that mollusks referred by him to *Vitrina*, but really belonging to *Helicarion*, were very abundant in the Philippines, and that he was particularly struck with their activity, as they were able to leap from the ground by the sudden muscular action of the foot. Mr. Benson confirms this peculiar habit as existing in allied forms, as he has observed an East Indian species spring several inches from the ground; while a recent observer ascribes to our native *Vitrina* similar but even more remarkable habits.

Geographical Distribution.—The genus as now usually restricted is a group of small and delicately-shelled species, found chiefly in the cold and temperate regions of the northern hemisphere, being said by Tryon to be replaced by *Helicarion* and other groups in the countries beyond the limits of its range.

The truth of our location of the area of greatest evolutionary activity in Mid-Europe is again further emphasized and confirmed by the present group, in which evolutionary progress lies in the direction of the atrophy and eventual loss of the shell, a feature most advanced in the endemic *Vitrinæ* of that region.

Geological History.—A species of *Vitrina*, named *villyensis* by Boissy, has been reported from the Lower Eocene of France, and a *Vitrina*, named *obliqua* by Meek and Hayden, is found fossilized in North America; while Prof. Sandberger indicates the genus as occurring in Germany in the deposits of the Lower Eocene, Lower, Middle, and Upper Miocene, and Middle and Upper Pleistocene.

Vitrina pellucida (Müller).

- 1774 *Helix pellucida* Müller, Verm. Hist., ii., p. 15.
 1812 — *limacoides* von Alten, Syst. Abh., p. 85, pl. xi., f. 20.
 1818 — *elliptica* Brown, Mem. Werner. Soc., ii., p. 525, pl. 24, f. 8.
 1821 *Vitrina beryllina* C. Pfeiffer, Deutsch. Moll., p. 47, pl. 3, f. 1.
 1830 — *mülleri* Jeffreys, Trans. Linn. Soc., xvi., p. 325.
 1830 — *diaphana* Jeffreys, op. cit., p. 326.
 1830 — *draparnaldi* Jeffreys, op. cit., p. 326.
 1830 — *elongata* Jeffreys, op. cit., p. 327.
 1830 — *depressa* Jeffreys, op. cit., p. 327.
 1833 — *dillwynii* Jeffreys, op. cit., p. 506.
 1850 — *limpida* Gould, in Agassiz, Lake Superior, p. 243.
 1852 — *americana* Pfeiffer, Proc. Zool. Soc., London, p. 156.
 1857 — *angelice* Beck, Index, p. 1.
 1858 — *exilis* Morelet, Journ. de Conch., p. 8.
 1861 — *pfeifferi* Newcomb, Proc. Cal. Acad. Sci., p. 92.
 1877 — *baudoni* Delaunay, Journ. de Conch., xxv., p. 363, pl. 11, f. 5.
 1905 — *alaskana* Dall, Land and Freshw. Moll. Alaska, p. 35.



HISTORY.—*Vitrina pellucida* (*pellucida*, transparent) is our only representative of a group of closely-allied species, in which the internal organization is in many cases more distinctive than the external aspect of the shell.

The present species is dedicated with pleasure to Mr. Robert Welch, M.R.I.A., etc., of Belfast, one of the most enthusiastic and successful field naturalists of the day, whose assiduous researches are contributing so materially to increase our knowledge of the molluscan fauna of Ireland.

The species was first distinguished by Müller in 1774, and according to Dr. Gray was added to the British list in 1777, by Pennant, but this is an error, as the *Helix pellucida* of Pennant is described as an umbilicated species.

Considerable confusion exists in reference to this species, but it is generally accepted that the *Vitrina pellucida* of Müller is not identical with that of Draparnaud, the latter being more properly referred to the *Vitrina major* of Férussac, a species much more restricted in its range.

Dr. Jeffreys, in his more youthful writings, referred British specimens to several different species, as shown in the synonymy, but he afterwards united them under one name.

It is the *Helix virides* of Brown, the *Helix glaucina* of Sheppard, and according to Clessin the *Vitrina hiemalis* of Koch. Dupuy refers to it the *Vitrina teneriffæ* of Graells, while according to Dr. Leach, Colonel Montagu regarded it as the fry of *Helix nemoralis*. *Helix brevipes* of Turton is also the young state of the present species.

Description.—ANIMAL light-grey, HEAD and TENTACLES blackish; the faintly-spotted MANTLE is partially external, projecting in front of the shell, and placed on the dorsum of the animal, as in *Limax*; it is also reflected over the margin of the shell anteriorly, and is in addition furnished with a linguiform lobe on the right side, which extends partially over the apex of the shell; the TENTACLES are short and stout, with eye specks at the summits of the posterior pair; FOOT rather narrow, SOLE trifasciate, median area pale, darker marginally and at the caudal extremity, which is attenuated and prolonged beyond the margin of the shell; RESPIRATORY ORIFICE on right side of body and margined with black; REPRODUCTORY ORIFICE near middle of neck; EPIPHRAGM very thin, membranaceous, and transparent. The animal is very large, relatively to its shell, into which, however, it can ordinarily wholly withdraw the body, but if the tissues are saturated with moisture, no amount of irritation or force can compel its entire concealment.

SHELL subglobose; WHORLS 3–4, somewhat convex above, and rather flattened below, very thin, fragile, and transparent, sometimes with a yellowish or greenish tinge, changing to a dull whitish opacity in dead shells, which have laid exposed to the weather; there are a few indistinct lines of growth, and some exceedingly delicate spiral striation; SPIRE small, not prominent, and terminating in a blunt apex; BODY-WHORL large, voluminous, and somewhat oblique; SUTURE shallow, with minute striae or puckerings, and showing a narrow bordering; APERTURE somewhat oval, but encroached upon by the penultimate whorl; MARGINS simple, sometimes faintly pigmented, and at times slightly reflected around the slightly concave but imperforate umbilical region, where a delicate apertural film is sometimes present.

When containing the retracted animal, the shell appears of a chocolate-brown colour above, becoming blackish towards the aperture; on the underside, the penultimate whorl is of a paler chocolate-brown, and shows the whitish subtriangular renal organ about one-fourth of a revolution from the aperture, bordered outwardly at a little distance by an obliquely transverse black line.

Length, 7 mill.; width, 5 mill.; altitude, 4 mill.; and the average weight of an adult shell is about $\frac{1}{80}$ th of a grain.

INTERNALLY, the constituent ganglia and commissures of the œsophageal NERVE-RING are distinctly defined, and the abdominal ganglion adjoins the right pallial ganglion on the visceral loop; while the “organ of Semper”¹ has not been detected. The SUPRA-PEDAL GLAND is well developed and rather compact, occupying four-fifths of the length of the foot, and deeply imbedded in the tissues; the anterior part is enveloped by glandular cells, and the longitudinal folds and groove are well marked, but there is no fold on the roof; an important blood sinus accompanies the gland and is in parts adherent to it.

The CEPHALIC RETRACTORS are of the usual type, the main or central branch being affixed to the pharynx and giving off early in its course the lateral muscles to the OMMATOPHORES, from which arise the smaller subsidiary muscles to each of the lower TENTACLES.

The REPRODUCTIVE ORGANS are in our species simple and uncomplicated. The OVOTESTIS is pale in colour, imbedded in the substance of the LIVER or DIGESTIVE GLAND, and connected with the base of the ALBUMEN GLAND by a sinuate HERMAPHRODITE DUCT; the VAS DEFERENS soon after leaving the conjoined ducts is bent upon itself and also runs parallel with and close to the penis sheath, to which it is closely bound by a thin muscular sheath; the PENIS SHEATH is apparently formed by a simple thickening of the vas deferens, but its lumen is not central, being nearer the outer wall, and distally is of a glandular structure, separable into an upper and a lower portion, the vas deferens entering at the point of junction; the upper glandular section and one-sided swelling cannot be explained as a flagellum, as the retractor is affixed at that point; the PENIS SHEATH, the short smooth FREE OVIDUCT, and the globular SPERMATHECA with its short neck and bulbous base open almost together into the ample vestibule.

The ALIMENTARY CANAL is of the usual triodromous² type, consisting of an INGESTIVE TRACT, at the termination of which is the STOMACH; this is succeeded by a couple of INTESTINAL COILS and a RECTAL or excretory section, which opens outwardly close by the respiratory aperture.



FIG. 4.—Proximal end of Reproductive organs of *Vitrina pellucida* $\times 4$ (after Simroth).

The MANDIBLE or jaw is nearly a mill. from side to side, strongly convex from front to back, and of a crescentic shape, of a delicate amber colour, and bearing on its lower or cutting margin a prominent but bluntly-rounded median projection or beak; ends somewhat square and placed at an obtuse angle to the lower margin; the whole anterior surface is delicately cross-striate, while the line of attachment



FIG. 5.

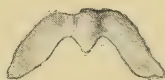


FIG. 6.

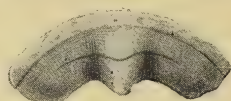


FIG. 7.

Mandible or jaw of *Vitrina pellucida*, showing some of the stages of its development to maturity.

FIG. 5.—Jaw of a young individual, magnified (after Wiegmann).

FIG. 6.—Jaw of a half-grown specimen, magnified (after Wiegmann).

FIG. 7.—Jaw of an adult, collected at Grantchester by Mr. Hugh Watson, and prepared by the Rev. Prof. Gwatkin, $\times 30$.

of the elasma is indicated by a darker sub-central line parallel with the lower margin, while a second darker line is seen near to and parallel with the upper convex margin indicating the depth of its insertion in the tissues.

The LINGUAL RIBBON is about one-and-half mill. in length, and of the usual oblong shape, composed of about one hundred transverse rows of teeth, each row containing a tricuspid central tooth, flanked by nine perfect laterals, arranged *en chevron*, and which are really only bifid, the endocone being obsolete and without cutting point; some observers have, however, described a supplementary endoconic cutting point as existing on the mesocone of the admedian teeth; the transition to the aculeate marginal teeth is abrupt, and the change in the direction of the rows very perceptible; the marginals are usually about twenty-four in number, and are all distinctly and strongly bifid, with a subsidiary serrate continuation along the outer margin of the reflected portion of each tooth, due to the presence of three or more sharply defined but minute denticulations.



FIG. 8 & 9.—Diagram showing the direction of the transverse rows of denticles and a row of representative teeth from the lingual ribbon of *Vitrina pellucida* $\times 160$. The specimen collected at Grantchester by Mr. Hugh Watson, and the palate prepared by the Rev. Prof. Gwatkin.

The formula of a Grantchester specimen, collected by Mr. Hugh Watson, and prepared by the Rev. Prof. Gwatkin, is

$$\frac{27}{2} + \frac{9}{2} + \frac{1}{1} + \frac{9}{2} + \frac{27}{2} \times 100 = 7,300.$$

Reproduction and Development.—The congress of this species does not appear to have been observed, but the egg-clusters, each composed of from eight to fifteen eggs, adherent together by albuminous matter, have been found from September to February.

The great Swedish naturalist, Nilsson, collected some individuals at the end of January, which he kept in captivity, and on February 19th noticed some eggs amongst the decaying leaves. These were roundly-oval, white, and subpellucid, with a central opaque spot, and were placed in little clusters of eight or nine eggs each. In the beginning of March, signs of a slow rotatory movement of the embryo were noticed, and on the 21st and 22nd of March the animals were excluded.

The young do not increase much in size during the summer months, but keep quite small, and are therefore difficult to find. They attain full growth during the colder months of the year, and die off in the early spring after a life-period of twelve to fifteen months.

Food and Habits.—*Vitrina pellucida* has an almost omnivorous appetite, and is credited with feeding upon Liverwort (*Jungermannia platyphylla*), mosses, fallen leaves, and decaying vegetable matter. It is also carnivorous, being said by Dr. Baudon to voraciously devour raw mutton, and will also feast upon the bodies of dead or dying worms and animals of its own or other species.

According to the observations of various authors, it is found everywhere on the limestone, is an abundant species on the clay, but is less common on the sandstones, although found in myriads about the roots of *Rosa spinosissima* on the sandhills near Swansea in Wales, and swarming on the mossy sand-dunes of the north coast of Ireland and elsewhere.

It ranges from sea-level to considerable altitudes, reaching a height of 1,750 feet in Glen Tilt, Perthshire, and 3,000 feet on Craig Calteach. In the Tyrol, it ascends to 7,000 feet, and was recorded by Mons. F. Roffiaen as living at the roots of *Arenaria* on the Riffelberg at an elevation of 9,000 feet above the sea.

V. pellucida is a common species in the winter months, at which period it attains its full growth, and is a bold and hardy animal, crawling actively about in the coldest weather, but is more gregarious than some of its congeners, and though most in evidence on damp days, or after a shower, has been seen moving actively about in the middle of the day even in dry weather. It is, however, ordinarily crepuscular and nocturnal in habit, coming out at sunset to feed, and retiring during the day beneath moss, stones, decaying wood, and other shelter, though according to Thompson it is particularly partial to concealment beneath the large, rough leaves of the Scotch elm (*Ulmus montanus*). It is capable of retiring completely within its shell, especially in dry weather, but during continued wet when its tissues are saturated with moisture is not always able to do so.

Though a geophilous species, it has, according to Mr. R. H. S. Smith and Herr Lindinger, the power of spinning a mucus-thread, and occasionally ascends trees, having been observed by Sterki at a height of three feet upon the trunks of the pine trees in the Swiss forests.

Mr. W. E. Collinge credits this species with possessing a strong homing¹ instinct, and personally vouches for it resorting to many cunning devices to escape the keen eyes of its enemies.

He says: "I have observed that when crawling on the edge of some stone or leafless twig, it will sometimes suddenly give its tail a jerk, sufficient to throw shell and owner to the ground, where it is soon lost to sight amongst the surrounding vegetation; at other times, it will roll away a few inches, and repeat the jumping motion. Another means of protection which it possesses is that of attaching to itself bits of leaves or soil, which entirely cover the shell and animal, thus causing it to resemble the natural surroundings."

The pulsations of the heart are very responsive to changes of temperature, beating only about fifty-one times per minute when placed on a cool table, but immediately increasing to ninety-eight per minute when placed upon the warm hand of the observer, but the action was then somewhat spasmodic, a momentary pause being followed by a rapid palpitation. Mr. Alder records a rapidity of one-hundred-and-twenty contractions per minute, but does not give the circumstances under which this number were observed.

¹ Monog. i., p. 312.

Geological History.—*V. pellucida*, though so fragile a species, has, nevertheless, been observed in a fossil state in our own and other countries.

PLEISTOCENE.—Mr. Miller Christy records it from the alluvial deposits of the Cann Valley, North Essex, and Mr. A. S. Kennard reports a specimen of this species in the collection at the Museum of Practical Geology from the Forest-Bed series of the Lower Pleistocene formation. It has also been met with among the Pleistocene remains found in the Ightham fissure, Kent.

In Germany it is mentioned by Sandberger as having been found in an imperfect state in the Pleistocene tufa at Cannstadt in Wurtemberg, and Weimar in Saxe-Weimar.

In France, according to Mr. Blackmore, it has been found at the base of lœss or Pleistocene fluvio-marine sand (*sable aigre*) at Menchecourt near Abbeville in the department of the Somme.

HOLOCENE.—Mr. Kennard reports its occurrence in the pre-Roman peat deposits at Westbury-on-Severn, Gloucestershire; in a post-Roman hillwash at Ashford, Kent; a hillwash at Greenhithe, Kent; and in the comparatively modern deposit at East Farleigh near Maidstone.

In Ireland it has been found by Mr. R. Welch in the deposits at Rosapenna, Donegal; by Mr. J. G. Milne in those on the Warren, Achill Island, Co. Mayo; and by Messrs. Collier and Standen at Dog's Bay, Connemara.

Variation.—*V. pellucida* varies comparatively little in size or shape. When full grown it may present a more flattened and oval outline (var. *depressiuscula*), or may be more globose (var. *dillwynii*), but these modifications are not striking. A var. *perforata* and a var. *minor* are described by Westerlund from Sweden, but no precise description of the latter is given. In colour, the shell varies from a crystalline transparency to a yellowish or greenish tint, the latter form being at one time described by Captain Brown as new, under the name of *Helix virides*. The occurrence of these colour variations has, however, never been systematically observed or recorded.

A very beautiful specimen, found by Mr. L. E. Adams at Coleraine, Co. Derry, is spirally encircled with two broad milk-white bands, which extend from the apex to the aperture of the shell.

Though I have never seen a British specimen of the true *Vitrina major* Fér. (*V. draparnaldi* Cuvier), yet continental authors almost universally describe it as a British species, and allocate it with the *Vitrina depressa* and *V. diaphana* of Jeffreys, while Captain Brown in his "Land and Freshwater Conchology," figures on pl. xx., f. 21, a specimen which appears referable to *V. major*, but of which he gives no particulars.

Though the opinion of American authors would seem to be in favour of specific status being granted to *Vitrina limpida*, the eastern North American species, and to *V. alaskana*, the inhabitant of the western part of that continent, as well as to *V. angelicæ*, of Greenland, and *V. exilis*, of North-eastern Asia, yet all these forms are unquestionably very closely related, and are probably merely the earlier offshoots from an identical stock, which do not yet display marked specific distinctions externally, but nevertheless according to the published descriptions do display a subtle gradation in the relative degree of shell deterioration such as might be logically expected from the geographical relationship of the areas they respectively occupy, while the internal structure of the various forms has not as yet been properly examined or compared.



FIG. 10. —*V. angelicæ* × 3, enlarged (after Binney).

This view is rendered the more probable by the striking and unusual absence of unanimity amongst authors, as to the limits of the range of the various forms; while the numerous conflicting records and identifications even by the same authors would seem to imply that the real divergence of the various forms is of the slightest.

Vitrina limpida, *V. alaskana*, and *V. exilis* may be subspecifically distinct, and appear to differ chiefly in the degree of compression or deterioration of the shell, and may be merely the links connecting these various assumed geographical races with the type.

VARIATIONS IN FORM OF SHELL.

Var. *depressiuscula* Jeff., Brit. Conch., 1862, p. 157 (not of Moq.-Tand.).

Vitrina draparnaldi Jeffreys, Linn. Trans., 1830, xvi., p. 326.

Vitrina depressa Jeffreys, op. cit.

Vitrina pellucida var. *depressiuscula* Jeffreys, 1862, op. cit.

SHELL rather oval and flatter on both sides, with the spire scarcely raised above the level of the last whorl.

The foreign range of this form has been confused with that of *V. pellucida* v. *depressiuscula* Moq., which is a var. of *V. major*.

This variety has also often been confused with the *V. elliptica* Brown, but the original figure of that author does not appreciably differ from the typical form. The Guernsey shells are said to be flatter and more elongate than the type, and may belong here or perhaps are the *V. major*, as surmised by Mr. Tomlin.

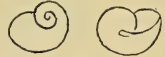


FIG. 11.

V. elliptica Brown
(after Brown).

ENGLAND AND WALES.

Channel Isles—Dead shells common in Guernsey, July 1886, B. Tomlin.

Cornwall W.—Truro, Dec. 1888 ! J. H. James.

Devon S.—Mount Edgcombe near Plymouth (Jeffreys, Linn. Trans., 1833, xvi., p. 506). Stoke Woods, Exeter, Feb. 1890, E. D. Marquand.

Sussex E.—Enumerated for Hastings and St. Leonards (Langdon, Nat. Hist. of Hastings and St. Leonards, 1878, p. 13).

Surrey—Haslemere (C. Pannell, junr., Journ. of Conch., Apl. 1902, p. 170).

Gloucester E.—Cooper's Hill near Cheltenham, March 1866 !

Hereford—Bishopwood, Ross ! Rev. R. W. J. Smart, 1885.

Warwick—Sutton (H. Overton, Journ. of Mal., Sept. 1900, p. 171).

Glamorgan—Plentiful towards end of autumn at the roots of *Rosa spinosissima* on the Swansea Burrows (Jeffreys, Linn. Trans., 1830, xvi., p. 327). As *Vitrina depressa* Jeffreys records two dead shells from Britonferry Wood near Swansea (Linn. Trans., 1833, xvi., p. 506).

Pembroke—North Cliff, Tenby, 1897 ! A. G. Stubbs.

IRELAND.

Louth—Collon, May 1904, P. H. Grierson.

Var. *dillwynii* Jeffreys, Linn. Trans., 1830, xvi., p. 326.

Vitrina dillwynii Jeffreys, op. cit.

Vitrina elongata Jeffreys, Linn. Trans., 1830, xvi., p. 327.

Vitrina pellucida var. *dillwynii* Jeffreys, Brit. Conch., 1862, i., p. 157.

Vitrina pellucida var. *brunnensis* Ulicny, Mal. Bl., 1884, p. 302.

Vitrina pellucida var. *bellardii* Pollonera, Moll. Piem., 1884, p. 19, ff. 31, 39.

SHELL more globular with the last whorl very convex and spire more prominent.

The sub-var. *brunnensis* is described as larger than the type, with a more elevated spire and a somewhat swollen last whorl. Diam., 7 mill.; alt., 4 mill.

The sub-var. *bellardii* is described as more globular than the type, but with a more depressed spire.



FIG. 12.—*V. pellucida*
var. *bellardii* Poll. (after
Pollonera).

WALES.

Glamorgan—Sandhills near Swansea at the roots of *Rosa spinosissima* (Jeffreys, Brit. Conch., 1862, p. 57). As *Vitrina elongata* Jeffreys recorded it as rare from Britonferry Wood near Swansea (Linn. Trans., 1830, xvi., p. 327).

CONTINENTAL DISTRIBUTION.

Moravia—Sub-v. *brunnensis*, Zittawathal, and foot of Gelbenberges near Brunn.

Italy—Sub-var. *bellardii*, Vallestrella, and Aosta, Piedmont (Pollonera, l.c.).

Sweden—Dr. Westerlund records var. *dillwynii* from Sweden, and sub-var. *brunnensis* from Valdemarsudda in Djurgården, Stockholm, and Brännkyrka in Södermanland (Westerlund, Syn. Moll. Extram., 1897, p. 31).

Monst. **sinistrorsum** Cockerell, Science Gossip, 1897, p. 262.

SHELL with coiling reversed or sinistral.

Switzerland—Dr. Brot records the finding of a sinistral specimen near Geneva (Proc.-Verb. Mal. Soc. Belg., April 1877).

V. pellucida alaskana Dall, Land & Freshw. Moll. Alaska, 1905, p. 35.

Vitrina pfeifferi Newcomb, Proc. Cal. Acad. Sci., 1861, ii., p. 92.

Vitrina alaskana Dall, op. cit.

WITH *Vitrina alaskana* Dall, the West American form of the species, the name of the author, Dr. W. H. Dall, of the National Museum, Washington, D.C., is here associated in appreciative recognition of the many elaborate and priceless contributions to conchology from his pen, more especially those in elucidation of the phylogeny and other of the more profoundly interesting departments of the study.



Wm. H. Dall

SHELL translucent with a marked greenish tinge, and is larger and flatter, while the size of the whorls increases more rapidly than the eastern form *V. pellucida limpida*.



FIG. 14.

FIG. 15.

FIG. 14.—*V. alaskana* Dall (after W. G. Binney).
FIG. 15.—Median, admedian, and marginal teeth of *V. alaskana*, highly magnified (after W. G. Binney).

Prof. Cockerell describes the ANIMAL of a Colorado specimen as possessing the head and tentacles of a dark purplish-grey; foot greyish-white; mantle dark grey, minutely speckled with whitish.

The LINGUAL MEMBRANE is described by Binney as having a formula of $50 + 1 + 50$ with ten perfect laterals on each side.

This is the species or race which prevails over the western coast of North America, and is the most common shell on the islands of the Behring Sea and on the continent near the sea in Alaska, being often found by the sea-beach under drift-wood. In its southern range it is absent from the warm lowlands, chiefly affecting lofty altitudes and reaching a height of 10,500 feet in the Sierra and Rocky Mountain ranges; while northwards it extends to Vancouver, the Alaskan Peninsula, the Aleutian and Shumagin Islands, and also as far as the Pribiloff Islands in the Behring Sea.

NEARCTIC DISTRIBUTION.

New Mexico—Fort Wingate (Binney, Manual, 1885, p. 88); Jemez Sulphur Springs; Clouderoft, and among dead leaves by Pecos River at Vallé Ranch, Nov. 1902, T. D. A. Cockerell.

Colorado—Found throughout the state, and recorded from or found at Breckenridge by H. Prime; common among the Beaver dams, Empire, by J. D. Putman; head of Gunnison River, by W. G. Binney; Boulder, by Prof. Cockerell; and White Earth River, by Ingersoll; also at Dillon, Summit Co.; Swift Creek, Custer Co.; Grand Mesa; also near Mam Mountains; and at roots of *Equisetum*, Buzzard Creek, Mesa Co.; Cottonwood Gulch, Saguache Co.; west fork of Surface Creek, Delta Co.; east fork of Arkansas River, Lake Co.; near Cattle Creek, Garfield Co.; and Routt Co., by Prof. Cockerell; as well as Howardsville, St. Juan Co., by E. Ingersoll.

Utah—City Creek Cañon (Call, Bull. U.S. Geol. Surv., 1881, p. 25). St. George (Binney, Manual, 1885, p. 88).

Idaho—(Pilsbry, Proc. Acad. Nat. Sci. Philad., 1889, p. 196).

Nevada—Sierra Nevada (Call, l.c.).

Nebraska—Rare, Cedar and Knox Counties (Anghey, Surv. Terr., 1877, p. 698).

California—Carson Valley and Nevada to Owen's Valley (Binney and Bland, Man., 1869, p. 28). Banks of Lake Tahoe, J. G. Cooper, and all over California as far south as Fresno Co. (Binney, Manual, 1885, p. 480).

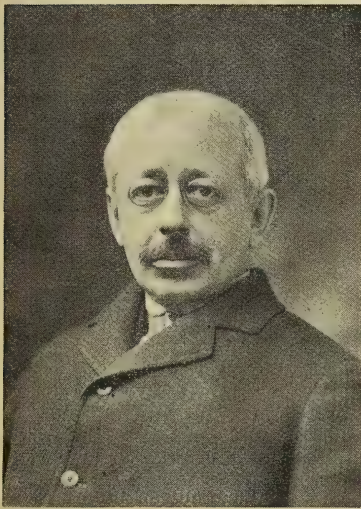
British Columbia—Nanaimo, Vancouver Island (Dall, op. cit.).

Alaska—Muir Inlet; St. Paul, Kadiak Island; Popof and Unga Islands of the Shumagin group; Akutan, Unalga, Rooluk, and Unalaska of the Aleutian chain; St. Paul and St. George Islands, Behring Sea, in tall grass of bluff, fifty feet above the sea (Dall, op. cit., p. 35).

V. pellucida limpida Gould in Agassiz, Lake Superior, 1850, p. 243.

Vitrina pellucida DeKay, Zool. N.Y. Moll., 1843, p. 25, pl. iii., f. 42.

Vitrina americana Pfeiffer, Proc. Zool. Soc. London, 1852, p. 156.



TO Mr. Bryant Walker, of Detroit, Michigan, U.S.A., the East American form, *V. limpida*, is here dedicated, in cordial acknowledgment of his great influence and energy in the promotion of the study of American conchology, in which he himself is so accomplished a student, as well as in grateful appreciation of the invaluable and consistent help he has rendered in the preparation of the "Monograph."

ANIMAL whitish, greyish, or blackish; head, tentacles and eyes black; tentacles very short; SHELL more globose and smaller than *alaskana*.

The MANDIBLE does not differ appreciably from that of *V. pellucida*, and although the figured specimen (fig. 19) shows certain small differences, these were not confirmed in the additional specimens examined.

The LINGUAL MEMBRANE is stated by Binney to have the formula $30+1+30$, with nine perfect laterals; another example showed $39+1+39$ with ten perfect laterals, while Morse records a Maine specimen as possessing thirty rows of teeth with a formula

of $25+1+25$ and nine laterals. A Pennsylvanian specimen sent by Mr. G. H. Clapp did not agree with the descriptions or figures given by Morse or by Binney, but was in accord with that of the type form as figured on p. 6 of the present volume.



FIG. 17.



FIG. 18.

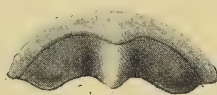


FIG. 19.



FIG. 20.

FIG. 17.—Median, admedian, and marginal teeth of *V. limpida* Gould, magnified (after W. G. Binney).

FIG. 18.—Jaw of *V. limpida* Gould, highly magnified (after W. G. Binney).

FIG. 19.—Jaw of *V. limpida* Gould $\times 30$, from Leetsdale, Pa., U.S.A., collected by Mr. G. H. Clapp and prepared by Mr. W. Moss.

FIG. 20.—Shell of *Vitrina limpida* Gould (after W. G. Binney).

This form is the eastern American variety, extending from New York on the east to Alberta on the west, and from Pennsylvania in the south to Hudson Bay Territory on the north. Dr. Dall is of opinion that the specimens reported from the Rocky Mountains by Ingersoll are really referable to *alaskana*.

NEARCTIC DISTRIBUTION.

- Keewatin**—In damp woods, Norway House (Bell, Geol. Surv. Canada, 1879).
Ontario—Rideau River, Bryant Walker. Moose Factory and James Bay (Dall, Moll. of Alaska, 1905, p. 37).
Quebec—Abundant under cliffs by River St. Lawrence at St. Joseph's; and fine specimens on banks of tributary of St. Lawrence River at St. Charles near St. Romauld's; also frequent, Bay of Barachois, Gaspé, May 1892 (A. W. Hanham, Naut., Oct. 1893, and Jan. 1897). Anticosti (Litchford, Amer. Nat., 1884, p. 1052).
Manitoba—Reed River and Lake of the Woods. Among moss, beside a slough near Carberry (R. M. Christy, Journ. of Conch., April 1885, p. 345).
Alberta—Red Deer and Laggan (Dall, op. cit., p. 37).
New Brunswick—(Gould, Invert. Mass., 1870, p. 394).
Massachusetts—Very thin and transparent specimens under old boards, at an old saw mill, Westport (J. H. Thomson, J. of Conch., iv., Oct. 1885, p. 370).
Vermont—(Gould, l.c.).
Pennsylvania—A colony at Leetsdale, Allegheny Co., Nov. 1905! G. H. Clapp.
New York—Immensely abundant and fine by ditch-sides on the flats near Mohawk, Herkimer Co., Nov. 1864. Found also in a yard at Litchfield, in the same county, by Dr. Brown (Lewis, Pr. Acad. Nat. Sci. Philad., 1873, p. 107). Plattsburgh, locally abundant, G. H. Hudson. Cayuga Lake Valley (Banks, Nautilus, April 1892, p. 137); also at Pittsford, in Monroe Co., J. Walton; Troy, Utica, and Palmyra (Binney, Manual, 1885, p. 177).
Maine—Caribou and Presque Isle; also in considerable numbers at Fort Kent (Nylander, Nautilus, Jan. 1900, p. 104). Bethel, Portland, and on several islands in and near Casco Bay, also on St. John's River in the extreme north of the state (E. S. Morse, Pulm. Maine, 1864, p. 11).
Michigan—Abundant on Line Island, St. Mary's River. Found also at Charlevoix and Traverse City (Bryant Walker, 1899).

V. pellucida exilis Morelet, Journ. de Conch., 1858, p. 8.

SHELL of a whitish or translucent glassy hue, of a smaller size and not so depressed as *alaskana*.

The jaw according to Binney does not differ from that of its allies.

The dentition is given by Binney as 37 + 1 + 37 with 7 perfect laterals.

Found in North-eastern Asia and adjacent islands, embracing, according to Dall, the Commander and Kurile Islands, the Aleutian and the Behring Islands, the Tschuktschis Peninsula, North-east Siberia, east of the Stanovoi Mountains, and north of Aian, also in Japan, and at Petropavlovsk in Kamtchatka. Dr. Dall is, however, now of opinion that *exilis* has not yet extended beyond the Commander Islands, and that the more eastern records are probably all referable to *alaskana*.



FIG. 21.

FIG. 22.

FIG. 21.—Median, admedian, and marginal teeth of *V. exilis*, highly magnified (after W. G. Binney).

FIG. 22.—Shell of *Vitrina exilis* Morelet (after Dall).

Geographical Distribution.—*Vitrina pellucida* is a very ancient and widely dispersed species, extending entirely over Europe, while geographical races or allied species exist in Siberia, North America, and in the Himalayan region. Dr. Dall records *V. pellucida* as ranging over Siberia from the Ural Mountains to the River Lena, and as also inhabiting the basin of the Amur, the Island of Saghalien, and the region between the Amur and the Stanovoi range of mountains.

BRITISH ISLES.

Vitrina pellucida is generally distributed throughout the British Isles, appearing to be most plentiful in the north; specimens have been verified from every county and vice-county into which these islands have been divided, except Wiltshire North in England; Aberdeen North, Ebudes South and Shetland Isles in Scotland; and Carlow and Mayo East in Ireland.

GERMANY.

Probably diffused throughout the country and has been recorded for Alsace, Baden, Bavaria, Brandenburg, Brunswick, Franconia, Galicia, Gotha, Hanover, Hesse, Hessen-Cassel, Lorraine, Lusatia, Mecklenburg, Nassau, Oldenburg, Pomerania, Prussia, Reuss, Rhenish Prussia, Saxony, Schleswig-Holstein, Silesia, Thuringia, Weimar, Westphalia, and Wurtemberg.

NETHERLANDS.

Belgium—Has been observed in the provinces of Brabant, Flanders East, Flanders West, Hainault, Liège, Limburg, Luxemburg, and Namur.

Holland—Maastricht in the province of Limburg.

FRANCE.

Recorded from many of the more northern departments, and appears to be represented by *Vitrina major* in the more southern districts. *Vitrina pellucida* has been recorded for the following districts:—Ain, Aisne, Allier, Ardennes, Ariège, Aube, Aude, Basses-Pyrénées, Champagne Meridionale, Charente Inférieure, Côtes-du-Nord, Drôme, Eure, Eure-et-Loire, Gard, Gers, Gironde, Haute Garonne, Hautes Pyrénées, Isère, Landes, Loiret, Loire Inférieure, Maine et Loire, Morbihan, Moselle, Meuse, Nord, Oise, Pas-de-Calais, Pyrénées-Orientales, Rhone, Sarthe, Savoy, Seine, Seine-et-Marne, Seine-et-Oise, Somme, Var, Vienne, Vosges, and also as *Vitrina baudoni* from the department of the Manche.

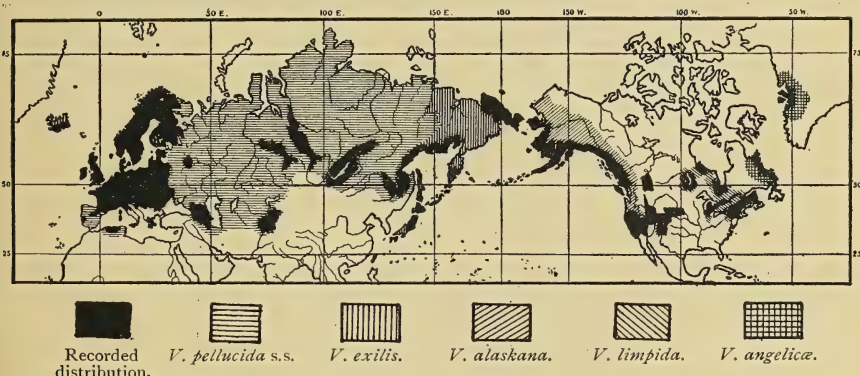


FIG. 23.—Map of the Geographical Distribution of the segregate forms of *Vitrina pellucida* Müller.

SWITZERLAND.

Found almost throughout the country, its occurrence being noted in the cantons of Appenzell, Basel, Berne, Geneva, Glarus, Grisons, Neuchâtel, Saint Gall, Schwytz, Vaud, Valais, and Zurich.

ITALY.

Pollonera records *V. pellucida* from several localities in Piedmont. Dr. Kobelt possesses examples from Signor Adami, collected at an altitude of between 6,000 and 7,000 feet, near Como in Lombardy. Pirona records it for Tuscany; Benoit and Platania from the Madonie near Messina in Sicily; and Westerlund for the Island of Sardinia.

SPAIN AND PORTUGAL.

Spain—*V. beryllina* is recorded by Dupuy from Madrid, New Castile; and by Fagot from Pantecosa in the province of Huesca.

Portugal—(Dumont and Mortillet, Cat. Savoie, 1857, p. 20).

BALKAN PENINSULA.

Epirus, the Grecian Archipelago; also in **Servia**, **Roumania**, and **Wallachia**.

AUSTRO-HUNGARY.

V. pellucida appears diffused throughout the empire, and records have been seen for Austria, Banat, Bohemia, Bosnia, Carinthia, Carniola, Croatia, Galicia, Hungary, Moravia, Transylvania, Tyrol, and along the Austrian littoral.

SCANDINAVIA.

Norway—Extends all over Norway up to 70° north lat. As *V. angelicæ* Miss Esmark records it as an inhabitant of Nordland, East and West Finnmark; Westerlund for the Lofoten Islands; and Sars for Bergen.

Sweden—Extends all over Sweden as far as Lulea Lapland, 68° north lat., as well as on the Island of Gothland.

Denmark—Indicated for Jutland and islands, and also for the **Faroës**; while as *V. angelicæ* it is reported from **Iceland**.

RUSSIA.

Vitrina pellucida is said to be found in Northern and Southern Russia; and is especially recorded for Moscow, Livonia, Courland, Poland, and the Cis- and Trans-Caucasian region; it is common throughout Finland, and extends to the extreme north of Lapland, whence *V. angelica* is reported by Moellendorff.

NORTH AFRICA.

Algeria—J. W. Flower (Jeffreys, Brit. Conch., 1869, v., p. 157).

ARCTIC AND SIBERIAN SUB-REGIONS.

Siberia—Recorded for Tomsk in the Obi Valley, Jenissei Valley, Irkutsk, the Baikal and Tranbaikalian region, the Valley of the Amur, and Kamtchatka.

Turkestan—Recorded for near Yarkand by Nevill.

Cashmere—Godwin-Austen, on the authority of Stoliezka, records it from Mataian, Dras, Lálul, and from the north of Zoji La, but thinks that as the animal of the European form is pale in colour, while the Cashmere form is "blackish with short tentacles," that they may prove to be distinct species.

N.E. Asia—*V. pellucida exilis* inhabits North-eastern Asia, reaching from Tschukschis peninsula in the north, as far as Japan in the south, overlapping on the east the area inhabited by *V. pellucida alaskana*, and on the west mingling with the typical form.

NEARCTIC REGION.

Labrador—*Vitrina angelica* is recorded by Tryon for Labrador.

Greenland—Dr. Westerlund records this species as *V. angelica* for Godhavn, from which latter place Dr. Jeffreys recorded it as *V. pellucida*.

Canada—*V. pellucida limpida* is recorded as inhabiting the provinces of Alberta, British Columbia, Keewatin, Manitoba, New Brunswick, Ontario, and Quebec in the British Possessions; and *V. pellucida alaskana* from British Columbia.

United States.—*V. pellucida limpida* also exists in Maine, Massachusetts, Michigan, Pennsylvania, New York, and Vermont.

V. pellucida alaskana is on the latest authority now considered to be restricted to the Pacific coast, from California to Alaska, including the Behring and Aleutian Islands, and to the States of Colorado, Idaho, Nebraska, Nevada, New Mexico, and Utah.



FIG. 24.—Sand dunes, Rosapenna, Co. Donegal, whose mossy areas swarm with *Vitrina pellucida* (photo. by Mr. R. Welch)

Distribution of *Vitrina pellucida* (Müller).

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
PENINSULA	
1 Cornwall W.	41 Glamorgan
2 Cornwall E.	42 Brecon
3 Devon S.	43 Radnor
4 Devon N.	44 Carmarthen
5 Somerset S.	45 Pembroke
6 Somerset N.	46 Cardigan
	NORTH WALES
7 Wiltshire	47 Montgomery
8 Wilts S.	48 Merioneth
9 Dorset	49 Carnarvon
10 Isle of Wight	50 Denbigh
11 Hants S.	51 Flint
12 Hants N.	52 Anglesey
13 Sussex W.	
14 Sussex E.	TRENT
15 Kent E.	53 Lincoln S.
16 Kent W.	54 Lincoln N.
17 Surrey	55 Leic. & Rutld.
18 Essex S.	56 Notts.
19 Essex N.	57 Derby
20 Herts.	
21 Middlesex	MERSEY
22 Berks.	58 Cheshire
23 Oxford	59 Lancashire S.
24 Bucks.	60 Lan'shire Mid
	HUMBER
25 Suffolk E.	61 S. E. York
26 Suffolk W.	62 N. E. York
27 Norfolk E.	63 S.W. York
28 Norfolk W.	64 Mid W. York
29 Cambridge	65 N.W. York
30 Bedford	
31 Hunts.	66 Durham
32 Northampton	67 Northumb. S.
	68 Cheviotland
	LAKES
33 Gloucester E.	69 Westmorland
34 Gloucester W.	70 Cumberland
35 Monmouth	71 Isle of Man
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easterness
76 Renfrew	W. HIGHLANDS
77 Lanark	97 Westerness
	98 Main Argyle
E. LOWLANDS	99 Dumbarton
78 Peebles	100 Clyde Isles
79 Selkirk	101 Cantire
80 Roxburgh	102 Ebudes S.
81 Berwick	103 Ebudes Mid
82 Haddington	104 Ebudes N.
83 Edinburgh	
84 Linlithgow	N. HIGHLANDS
	105 Ross W.
E. HIGHLANDS	106 Ross E.
85 Fife & Kinross	107 Sutherland E.
86 Stirling	108 Sutherland W.
87 Perth S. & Clkn.	109 Calthness
88 Mid Perth	
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincairdine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

GENUS *HYALINIA* Charpentier.

(*Vitre*a, E. A. Smith; *Zonites*, Forbes and Hanley; *Helicella*, Tate;
Hyalina of many authors).



Dr W Kobelt.

THE genus *Hyalinia* (ὑάλινος, transparent) was first published in 1837 by Charpentier, the name being suggested by Agassiz. The use of the name *Hyalinia* has been objected to on the ground that it has already been used in the somewhat similar although not identical terms of *Hyalina* and *Hyalinus* to distinguish genera of Reptilia and Lepidoptera. Mr. E. A. Smith has, therefore, suggested that the term *Vitre*a proposed by Fitzinger as a sectional name for *Hyalinia crystallina* should be extended in its scope to embrace the group and replace *Hyalinia*. I have,

however, preferred to use the term *Vitre*a in the restricted sense intended by the original author.

The genus, as now defined, embraces the thin and more or less transparent species of medium or small size, which have been by common consent removed from their former close association with the typical *Zonites*, a group of larger and duller shells now almost confined to South-eastern Europe, though formerly ranging further westward, as testified by their remains in the inter-glacial deposits of the Neckar Valley, as well as in those of the Seine.

The *Hyaliniae* are subdivided by various authors into many groups or sections, in accordance with anatomical or testaceous characters. In this country we possess representatives of *Euhyalinia*, *Polita*, *Vitre*a, *Euconulus* and *Zonitoides*.

With the genus *Hyalinia*, Dr. W. Kobelt, of Sachsenhausen, in Nassau, is associated, in token of his long and invaluable labours in the cause of conchology, and in recognition of the estimation in which his many admirable works are held.

Generic Characters.—**EXTERNALLY**, the *Hyaliniae* are distinguished by the thin, glossy, translucent, and usually depressly-coiled shells of moderate or small size, with sculptured nepionic whorl, and obliquely crescentic simple aperture usually without any noticeable thickening or expansion of the margins, although in certain localities some of the species display a tendency during adolescence to the formation of a row of ill-defined denticles parallel with the basal margin.

The ANIMAL is of an elongate form, with a narrow FOOT, distinctly tripartite SOLE, and well-marked PEDAL GROOVES; the TAIL bears behind a small longitudinal slit, which is the opening of the CAUDAL GLAND, and the MANTLE does not extend beyond or only slightly overfolds the margin of the shell when the animal is extended.

INTERNALLY, the asymmetry of the ganglia of the VISCERAL CHAIN is very striking in the largest species, the large size of the right PALLIAL GANGLION being in correlation with the dextral organization of the animal, and in striking contrast to the organization in *Planorbis*, where an opposite condition prevails; the OTOCYSTS occupy a less inferior position than is usual in *Helix*, and contain innumerable otoconia; the ALIMENTARY CANAL is of the triodromous type, but with a very short and limited intermediate tract, held in position, as is usual, by the bending forward of the anterior AORTA.



FIG. 26.—One of the Otoconia of *Hyalinia*, highly magnified (after Schmidt).

The CEPHALIC RETRACTORS arise from the strong columellar muscle; the PHARYNGEAL and TENTACULAR retractors usually originating independently therefrom, the left tentacular muscle being often most distant in position from the pharyngeal.

The REPRODUCTIVE ORGANS differ from those of *Helix* in their greater simplicity and absence of accessory parts and by opening exteriorly much more to the rear. They present generally little specialization; the VAGINAL GLANDS may, however, be well developed, and the PENIS-SHEATH is in some of the larger forms surmounted by an EPIPHALLUS, in which the spermatophore is probably really secreted, although the median expansion of the VAS DEFERENS, which is sometimes called the epiphallus, is thought by some to be the more probable place of its formation.

The RADULA is characterized by the comparatively few and loosely-ranked teeth, which are predominantly aculeate and of the carnivorous type, differing thus from *Helix*, in which aculeate marginals are not generally present.

The MANDIBLE or jaw is oxygnathous,¹ variable in substance and strength, with usually a faintly-marked median beak or rostrum, differing thus from *Helix* in which the jaw is ribbed or odontognathous.

Food and Habits.—The *Hyaliniæ*, though according to Lindinger capable of spinning mucus threads, are strictly geophilous, and partial to shade and moisture, their prevalent colouring being procryptic and such as favours their concealment amongst stones or wood; they are nocturnal in habit, hiding during the day beneath stones and rubbish, and usually venturing forth by day only during wet and showery weather.

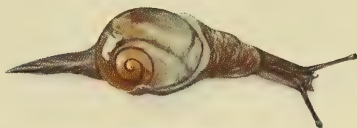
The species are all more or less inclined to a carnivorous or predacious life, though feeding readily upon vegetation. A means of defence other than that afforded by their procryptic colouring and retiring habits is believed to be the somewhat nauseous odour of garlic emanating from many of the species.

A further surmised protection is said to be afforded by the rapid and forcible expulsion from the dorsal integument of numerous bodies, which in certain features resemble the urticating Nematocysts, and are known as Phylacites.

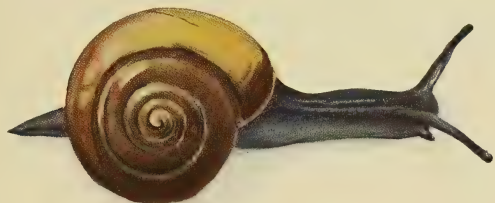
ZONITIDÆ.



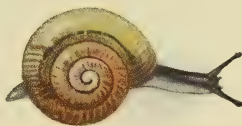
1. *Vitrina hibernica* Taylor, $\times 4$.
Collon, Co. Louth, P. H. Grierson.



Vitrina pellucida Müll., $\times 2$.
Grange-over-Sands, J. D. Dean.



Hyalinia lucida Drap., $\times 2$.
Penally, Pembrokehire, H. Brooksbank, M.D.



Hyalinia radiatula Alder, $\times 5$.
ShIPLEY Glen, Yorks., F. Booth.



Hyalinia cellaria Müll., $\times 2$.
Hambleton. Cosham, Hants., C. S. Coles.



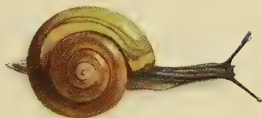
Hyalinia cellaria var. *compacta* Jeff., $\times 2$
(=*Vitreola scharffi* Kennard).
Lancaster. J. D. Dean.



Hyalinia helvetica Blum, $\times 2$.
Malham Cove, Yorks., J. D. Dean.



Hyalinia nitidula Drap., $\times 3$.
Silverdale, Lancashire, J. D. Dean.



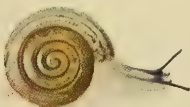
Hyalinia alliaria Miller, $\times 3$.
Kirkby Lonsdale. J. D. Dean.



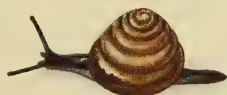
Hyalinia pura Alder, $\times 8$.
ShIPLEY Glen, Yorks., F. Booth.



Zonitoides excavatus Bean, $\times 4$.
Lower Wyresdale, Lancs., J. D. Dean.



Hyalinia crystallina Müll., $\times 10$.
ShIPLEY Glen, Yorks., F. Booth.



Hyalinia fulva Müll., $\times 8$.
ShIPLEY Glen, Yorks., F. Booth.



Zonitoides nitidus Müll., $\times 4$.
Lancaster, J. D. Dean.

The Phylacoblasts, within which the Phylacites are developed, were formerly mistaken for mucus glands; at first they resemble connective tissue, but the protoplasmic contents and nucleus disappear when the contained Phylacite is developed. They are restricted to an area, irregular in shape and variable in extent, at the most posterior part of the dorsum, which is partially overspread by the mantle, and distinguished from the surrounding integument by its slighter pigmentation. In adults there is but a single layer of Phylacoblasts, whereas in the young there may be two or three layers in different stages of development.

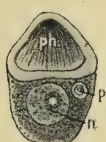


FIG. 27.

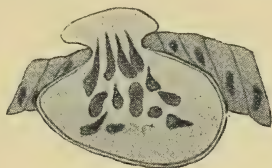


FIG. 28.



FIG. 29.



FIG. 30.

Phylacoblast and Phylacites, showing the origin and development of the Phylacite, highly magnified (after André).

FIG. 27.—Phylacoblast, showing a developed Phylacite (*ph.*), a developing one (*p*), and the nucleus of the secretory cell (*n*).

FIG. 28.—Phylacite during expulsion, showing the development of the fungiform shape, and the change in position and character of the contained sphaerules.

FIG. 29.—Phylacite, showing the mushroom form and concentric structure.

FIG. 30.—Phylacite, with less expanded head, but showing the pointed and now externally projecting toxic sphaerules, which during development and before expulsion were rounded and internal.

A *Phylacite* (φύλαξ, defender) is an ovoid body, about one-tenth of a millimetre long, composed of a clear or slightly-yellowish granular substance, surrounding a vesicle, containing 3-20 rounded, refractive sphaerules, the whole lodged within the parent-cell. On expulsion the Phylacite assumes the form of a mushroom, and the internal refractive sphaerules become pyriform and protrude beyond the base of the stem, and it has been conjectured by Prof. André, their discoverer, that these projecting and pointed sphaerules may be the active defensive agents and possess some toxic property.

Enemies.—Birds are great enemies of the present group, and devour at times large quantities. *Hyaliniæ* have been found in the crops of partially-fledged sparrows, while as many as 416, in addition to other objects, have been taken from the crop of a single nestling Stockdove by Mr. C. E. Wright. Perhaps, however, the most destructive creatures to this and allied groups are the Diptera, which destroy large quantities of mollusca even in the egg state.

Geological History.—According to Sandberger and others, the *Hyaliniæ* have been found in every formation, from Holocene down to the lowermost Eocene, and the first-named author records the genus doubtfully from the "Steinkohle beds" beneath the lias. In this country, however, the genus is not represented from beneath the Oligocene beds, while existent species have not hitherto been found below the Pliocene deposits.

Geographical Distribution.—The genus *Hyalinia* has a fairly compact distribution, although extending throughout the Holarctic regions, with representative species in more distant regions. It is one of the more dominant genera of the present day, and has been spread by commerce to New Zealand, Australia, and other of the weaker zoological regions, to the prejudice of their native fauna.

SUB-GENUS *Euhyalinia* Albers (em.).**Hyalinia lucida** (Drap.).

- 1801 *Helix lucida* Draparnaud, Tabl. Moll., p. 96.
 1805 — *nitida* Draparnaud, Hist. Moll. France, p. 117, pl. 8, ff. 23-25.
 1812 — *nitens* Von Alten, Syst. Verz., pl. 5, f. 10.
 1841 — *obscurata* Porro in Villa, Disp. Conch., p. 56.
 1843 — *blaureri* Shuttl., Mitth. Gesellsch. Bern, p. 13.
 1851 — *fulgida* Parreyss in Zelebor, Syst. Verz. Oesterr., p. 10.
 1864 — *planulata* Stabile, Moll. Piem., p. 30.
 1837 *Helicella draparnaldi* Beck, Index Moll., p. 6.
 1855 *Zonites (Aplostoma) lucidus* Moq.-Tand., Hist. Moll. Fr., ii., p. 75, pl. 8, ff. 29-35.
 1869 — *cellarius* Jeffreys, Brit. Conch., v., pl. 9, f. 1.
 1870 — *septentrionalis* Bourguignat, Rev. et Mag. Zool., xxii., p. 17, pl. 16, ff. 4-6.
 1870 — *farinesianus* Bourguignat, op. cit., p. 18, ff. 1-3.
 1870 — *navarriensis* Bourguignat, op. cit., p. 20, pl. 16, ff. 10-12.
 1879 — *calabrus* Paulucci, Faun. Calabr., p. 44, pl. 1, f. 2.
 1876 *Hyalina draparnaldi* Weinland, Weichth. Schwab. Alb., p. 34.
 1882 — *porroi* Paulucci, Faun. Sardinia, pl. ii., f. 4.
 1877 ***Hyalinia lucida*** Westerlund, Fauna Eur. Moll. Extram., p. 22.
 1877 *Oxychilus lucida* Jousseaume, Bull. Soc. Zool. France, ii., p. 403.
 1887 *Euhyalina draparnaldi* Clessin, Moll. Oesterr.-Ung., etc., p. 70, f. 12.
 1891 *Vitrea (Polita) draparnaldi* Smith, Journ. of Conch., vi., p. 339.



F. M. Hele

HISTORY. — *Hyalinia lucida* (*lucida*, clear) is the largest species of the group clustering around *H. cellaria*, and though unquestionably closely allied to and apparently blending with that species, is when studied shown to be undeniably distinct.

Although this species was known to Gray, Jeffreys, and others, its claims to specific rank were not acknowledged and it was regarded merely as a large, convex form of *H. cellaria*, and figured by both the above-mentioned writers as representative of that species.

Hyalinia lucida is here dedicated to Miss F. M. Hele, of Bristol, who has so long and so earnestly studied our native species, and who was really the first in this country to fully appreciate and successfully direct attention to the claims of *H. lucida* to specific rank.

Draparnaud himself initiated the confusion obscuring the nomenclature of this species, which he first described in 1801 as *Helix lucida*, but by some error

this name was in his later work transposed with that of *Helix nitida*, and this misapplication of names has led to much of the subsequent confusion.

In addition to the synonyms already quoted, the *H. tropidophora* Mabilie, from Corsica and Sardinia, the *H. porroi* Paulucci from Liguria, the *H. isseliana* and *H. antoniana* of the same authoress, from Sardinia, should

according to many conchologists be included; and judging from a type shell expressly selected for me by the late M. Bourguignat, the *Zonites subglaber* must also be considered as belonging to the present species, while Herr Julius Hazay records having received this species from the south of Russia under the name of *Hyalina diaphanella* of Krynicki.



FIG. 32.

FIG. 33.

FIG. 34.

FIG. 35.

FIG. 36.

Upper and basal aspects of certain *Hyaliniae* assumed to be synonymous with *H. lucida* (Drap.).

FIG. 32.—*Hyalinia antoniana* Paulucci, Sardinia (after Paulucci).

FIG. 33.—*Hyalinia porroi* Paulucci, Genoa (after Paulucci).

FIG. 34.—*Hyalinia isseliana* Paulucci, Lucca (after Paulucci).

FIG. 35.—*Hyalinia tropidophora* Mabilie, Bastia, Corsica (after Paulucci).

FIG. 36.—*Zonites subglaber* Bourg., Morbihan (after Bourguignat).

The sub-genus *Euhyalinia* embraces the larger species of *Hyalinia* with very glossy shells, and more numerous whorls than their allies of the related group *Polita*. The radula is characterized by a relatively small mid-tooth flanked by large and irregularly tricuspidate laterals and by the fewness of the teeth in each transverse row as well as on the membrane generally. The vas deferens is peculiar in forming a distinctly looped stiff median enlargement, which may be the secretory lumen of the capreolus.

Amongst themselves the species of the restricted group show a close affinity externally in shell and animal, and also present considerable general conformity in their internal organization, and it is evident that these forms have not yet diverged greatly from a common ancestral type.

Diagnosis.—The SHELL of *H. lucida* may be known from any other of the more closely-allied of our native species by its larger size, its more elevated and convex spire, and the rapid enlargement of the last whorl towards the aperture, which is perceptibly more oval and more obliquely placed in regard to the shell axis than in *H. cellaria*, its nearest ally. Immature shells approach much more closely to *H. cellaria*, but with attention to the differential points can usually be correctly separated.

From *H. nitidula* and its var. *nitens* it may be known by its larger size, narrower umbilicus, more glossy aspect, and by the lesser compression and dilatation of the last whorl.

The ANIMAL is remarkable for its deep slaty-blue colour, which extends to the side-areas of the sole, and in a less degree to the locomotory mid-area as well as to the internal organs; this character separating the animal from that of *H. cellaria*, in which the sole is usually quite pale.

INTERNALLY, it may be distinguished by the marked obliquity in position of the compound abdominal ganglia, due to the extreme shortening of the visceral commissure on the right side of the body; by the shape and the characteristic twisting of the epiphallus, and by the constant presence on the lingual membrane of one well-marked lateral denticle more than on the radula of *H. cellaria*, *alliaris*, *helvetica*, etc.

Description.—The ANIMAL is long and slender, attaining a length of 20 to 25 mill., and a breadth of $2\frac{1}{2}$ to 3 mill. when at fullest extension, and is obtusely rounded in front, and bluntly pointed behind, the TAIL projecting slightly beyond the shell when crawling; the BODY is of a dark blue-grey or slate colour dorsally, paler at the sides; the DORSAL GROOVES¹ enclose a row of granules or tubercles, and originate a series of more or less perpendicular transverse sulci, which are limited below by the LATERAL GROOVES,² beneath which and also close by the mantle the body is semitransparent, grey, and granulated; the flattened rugosities covering the body are smaller and more numerous near the head, while the interstices of the rugæ are translucent grey by transmitted light; the MANTLE is of a semitransparent gelatinous grey, its apparent dark colouring being due to the blue-black body of the animal beneath; it is darker around the RESPIRATORY ORIFICE, which region shows as a dark collar through the shell when the animal is extended; SOLE trifasciate, side areas bluish-grey or bluish-black, mid-area grey, not usually sharply defined in life, but more distinct after the animal has been scalded; CAUDAL GLAND longitudinal; OMMATOPHORES moderately long, stout and conical at the base, minutely granulate, of a greyish colour, but appearing almost black owing to the dark RETRACTOR within; LOWER TENTACLES short and grey.

The SHELL is very depressly convex above, less convex below; of a dark fawn colour above, whitish beneath; very glossy, scarcely semitransparent, and comparatively thick and strong, periostracum somewhat thick; SPIRE composed of six to seven convex and gradually enlarging whorls, the last perceptibly expanding towards the aperture, the surface ornamented with fine but somewhat irregular striation, which is most pronounced towards the sutures; UMBILICUS moderately and perspectively open, exposing the whole of the spire; APERTURE semilunar and very oblique relatively to the shell axis, and sometimes showing a calcareous thickening within, which is most pronounced basally; PERISTOME simple and direct, slightly reflected around the umbilicus; EPIPHRAGM very thin, transparent and membranous.

Diam., 15 mill.; alt. 6 mill. Average weight, $1\frac{1}{2}$ grains.

INTERNALLY, the NERVE COLLAR is characterized by a marked asymmetry of the visceral commissures, due to the loss of the abdomino-pallial commissures, caused by the approximation and fusion of the ABDOMINAL GANGLIA with that of the right PALLIAL nerve-centre, thus throwing the compound terminal ganglia towards the right side of the body; the HEART is formed by a large dark grey ventricle and a smaller, paler grey auricle; it is situate close by the triangular KIDNEY or renal organ, which is very conspicuously salmon-coloured with a dusky streak down the right side.

The REPRODUCTIVE SYSTEM shows a somewhat elongate, acinose OVOTESTIS, with a scarcely convolute but medially stout HERMAPHRODITE DUCT; ALBUMEN GLAND linguiform, gelatinous and semitransparent, of a clear yellowish or reddish-amber, or even a pale slate colour; VESICULA SEMINALIS distinct and recurved at the apex; the OVIDUCT is much folded, narrow above, more ample below, and of a clear bluish-grey; the attached SPERM-DUCT or prostate is opaque-white, granular, and of varying size; the slender VAS DEFERENS after passing the muscular strands binding it to the base of the penis-sheath enlarges abruptly and forms an elongate opaque-white vessel, with longitudinal stripings, beyond which to the junction with the epiphallus the duct is comparatively stout; the EPIPHALLUS is long, slender, and twisted, and beset internally with longitudinal rows of rounded depressions; it narrows somewhat where it joins the PENIS-SHEATH, which is an inversely club-shaped organ, abruptly contracted at its junction with the vestibule, and of a pearly-white colour, with opaque longitudinal stripes; RETRACTOR MUSCLE long, slender,



FIG. 37.—Renal organ and heart of *H. lucida* (Drap.), $\times 3$. *k.* kidney; *a.* auricle; *v.* ventricle.



FIG. 38.—Salivary glands, showing their character, arrangement, and point of entry to the buccal cavity, $\times 4$.

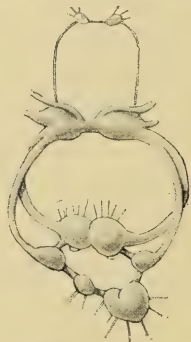


FIG. 39.—Nerve ring of *H. lucida* (Drap.), showing the buccal ganglia, the otocysts, and the obliquity of the visceral chain, $\times 14$.

and terminal, passing through the right tentacular loop and becoming attached to the upper part of the oviduct; the SPERMATHECA is variable in shape, digitiform or crescentic, rarely oval, semitransparent, with a bright red or reddish-brown core, united to the oviduct by a muscle at the crown; its duct is about double the length of the vesicle, and sometimes striped longitudinally with opaque white, thin above, but gradually widening below, abruptly flexed a little below the vesicle and attached to the oviduct; FREE-OVIDUCT slender above, becoming more ample below the cream coloured VAGINAL GLANDS, conspicuous and massed around the free-oviduct, concealing the junction of the spermatheca duct; ATRIUM or vestibule very short.

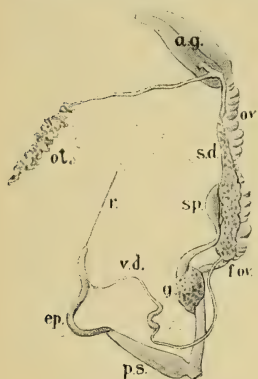


FIG. 40.



FIG. 41.

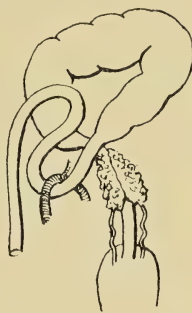


FIG. 42.



FIG. 43.

FIG. 40.—Reproductive organs of *H. lucida* (Drap.), $\times 3$. (Torquay, Mr. J. T. Marshall).

a.g. albumen gland; ep. epiphallus; ot. ovotestis; ov. oviduct; s.d. sperm duct; sp. spermatheca; v.d. vas deferens; r. retractor; f.ov. free oviduct; g. vaginal gland; p.s. penis sheath.

FIG. 41.—Penis-sheath, epiphallus, and vas deferens, showing indications of their internal structure as visible by transmitted light, $\times 6$ (after a photo. by Mr. W. Moss).

FIG. 42.—Alimentary canal of *Hyalinia lucida* (Drap.), showing the salivary glands and the mode of retention of the first anterior intestinal tract by the cephalic artery, $\times 3$.

FIG. 43.—Cephalic retractors of *Hyalinia lucida* (Drap.), $\times 3$.

THE ALIMENTARY SYSTEM displays a dark, dusky, and elongate OESOPHAGUS, longitudinally striped with a darker shade, around which are the large dull yellowish SALIVARY GLANDS; the oesophagus expands into a broad and long sub-cylindrical crop, which blends with the STOMACH at the termination of the INGESTIVE TRACT, where an abrupt flexure originates the INTESTINE, which is of the usual triodromous type,¹ but with inconspicuous flexures, of a greenish-grey colour, rather broad at the origin, but gradually narrowing; DIGESTIVE GLAND dark brown, with arterial system indistinct, the bile ducts discharging as is usual at the commencement of the second intestinal tract.

THE CEPHALIC RETRACTORS are a series of very powerful muscular straps arising from the upper surface and base of the columellar muscle. The two TENTACULAR retractors are uppermost and conjoined at their origin. The broad PHARYNGEAL branch originates immediately beneath the tentacular muscles, and before fixation to the buccal bulb gives off a strong muscular slip to the foot.

THE MANDIBLE or jaw is very convex, rather more than one millimetre across from side to side, of a very deep reddish amber colour, shading into an opaque deep brown at its greatly thickened upper margin; on the middle of the concave or cutting-edge there is a blunt, broad, and only slightly projecting rostrum or beak, while the ends of the jaw at each side are somewhat sinuous and inclined to be rather falciform at the outer angles.

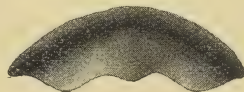


FIG. 44.—Mandible or jaw of *Hyalinia lucida* (Drap.), $\times 20$. (Bristol, Miss F. M. Hele).

THE LINGUAL RIBBON is comparatively large and of an oblong shape, about 5 mill. long, and about 1.25 mill. wide, composed of about thirty loosely ranked and slightly curved transverse rows of teeth, which converge towards the median line of the radula. Each row is composed of a small and distinctly tricuspid median tooth, with a long mesocone when unworn, but exceptionally showing a

truncated mesocone as so frequently found in *H. helvetica*; the true laterals are three in number, and much larger than the median tooth, and usually bear three irregular cusps each, although the ectocone is frequently deficient on the outer denticle; the fourth tooth is transitional, and has lost all traces of the ectocone, but frequently retains the endocone, which is occasionally apparently bifid, this appearance, however, according to Messrs. Moss and Boycott, being probably due to optical illusion; beyond are ten strictly aculeate marginals, which decrease rapidly in size as they approach the margin.

Some continental authors have described the radula as possessing but two 3-pointed lateral teeth, as in *H. cellaria*, while others credit the species with possessing four characteristic tricuspid laterals; but the bulk of British specimens have three characteristic laterals and one transition tooth on each side.



FIG. 45.—Transverse row of teeth from the odontophore of *Hyalinia lucida*, $\times 80$. The animal collected by Mr. F. G. Fenn at Isleworth, Middlesex, and the teeth prepared by Mr. J. W. Neville.

The formula of an Isleworth specimen is

$$\frac{1^0}{1} + \frac{1+3}{2} + \frac{1}{3} + \frac{3+1}{3} + \frac{1^0}{2} \times 30 = 870.$$

Reproduction and Development.—Nothing is known relative to the congress of this species, except that the seminal element is transferred by means of a spermatophore, which Dubrueil expressly declares is secreted in the enlarged section of the vas deferens. The eggs are described as globose in shape, one mill. to one-and-half mill. in diameter, of a dull or only slightly nacreous white, due to the somewhat cretaceous envelope; they are laid singly, and not in clusters, to the number of thirty to fifty, during a period extending from March to September; they hatch in about fifteen days, and become adult in the first months of their second year.



FIG. 46.—Spermatophore of *H. lucida* $\times 6$ (after a photo. by Mr. W. Moss).

Food and Habits.—*H. lucida* is a somewhat gregarious species, often living in colonies, and seldom found solitary or isolated. They are strictly geophilous, and according to some authorities quite subterranean in habit; they never climb trees, preferring moist and shady places in gardens, woods, etc., generally concealing themselves during the day and in dry weather under stones, in the crevices of walls and beneath tufted plants, or among humid moss and debris, crawling away almost instantly in search of shade if placed in the sun. When crawling the shell is usually carried leaning to the left side, and towards the rear, but is occasionally borne sloping strongly to the right, while according to Draparnaud the ommatophores are alternately extended during progression. The heart has been observed to pulsate forty times per minute at a temperature of 62° Fahr., when the animal was in repose, the contractions increasing to fifty-four when in motion; while at 64° Fahr. it attains a speed of forty-five beats in the same space of time.

Though in captivity feeding readily and thriving upon cabbage (*Brassica oleracea*), coltsfoot (*Tussilago farfara*), and dock (*Rumex obtusifolia*), yet they prefer animal food when obtainable, and this preference is probably indicated by the preponderance of aculeate teeth upon the radula. A number of this species bred in captivity by Miss F. M. Hele, and fed upon chopped beef during the winter months, when green food was unobtainable, actually devoured the weaker members of the colony when the supply of meat was discontinued.

Geological History.—*H. lucida* has not as yet been recorded or found fossilized in this country, but has been recently discovered in the top soil of Happaway Cavern, Devonshire.

In Italy it has, however, been found in the Post-Pliocene Terra Rossa deposits on Monte Pisano, also with mammalian bones in a marine conglomerate of the Upper Pleistocene limestone beds of Monte Tignoso near Leghorn, Tuscany, and in the calcareous tufa or travertine of Ascoli-Piceno in the Marche, while the var. *obscurata* occurs in "brèches osseuses" near Bastia, Corsica; and the sub-var. *septentrionalis* is recorded by Locard from the Holocene deposits near Lyons, France.

Variation.—The variation in this species lies chiefly in the more depressed or more elevated form of the spire, and in the coloration of the periostracum of the shell, which varies from a dark horny-amber colour to white. A minor form has been described by Baudon without precise characters, and Westerlund has distinguished a var. *major*, which he describes as attaining a diameter of eighteen mill. and an altitude of ten mill., a form which Watebled has recorded as occurring in the department of the Jura.

According to Mr. Hedley, who has had the opportunity of comparing specimens, the South European forms found at Mentone are characterized by a flatter spire, deeper suture, darker colouring, and fainter striation than the more northern type found in this country.

The allocation of many of the various forms to this species has been made in accordance with the expressed opinions of reputable continental malacologists, as reliable examples of many of the so-called species were not procurable for personal inspection.

VARIATIONS IN SHELL.

Var. *obscurata* Porro in Villa, Disp. Conch., 1841, p. 56.

Helix obscurata Porro in Villa, op. cit.

Helix blautneri Shuttl., Mitth. Gesellsch. Berne, 1853, p. 13.

Helix lucida var. *compressa* Dum. et Mort., Moll. Sav., 1852, p. 250.

Helix planulata Stabile, Moll. Piem., 1864, p. 30.

Zonites calabricus Paulucci, Faun. Calab., 1879, p. 44, pl. i., f. 2.

Zonites septentrionalis Bourg., Rev. et Mag. Zool., 1870, xxii., p. 17, pl. 16, ff. 4-5.

Hyalina porroi Paulucci, Faun. Sardinia, pl. 2, f. 1.

Hyalina obscurata var. *cloacarum* Paulucci, op. cit.

Hyalina obscurata var. *shuttleworthiana* Pini, Att. Soc. Ital. Sci. Nat.

SHELL nearly planorbiform above, with more closely coiled whorls; aperture less oblique.

The var. *obscurata* with its subsidiary forms would appear to be a southern geographical race, chiefly characterized by the planorbiform aspect of the upper surface and the somewhat more closely coiled whorls.

The sub-var. *blautneri* is described as being a little larger and more depressed than the type, but with a wider umbilicus, and more oblong aperture.

The sub-var. *septentrionalis* is slightly more convex beneath, and is described by Locard as habitually living in smaller colonies and ascending to greater altitudes than the typical shells, but they blend together insensibly in form. It is described as inhabiting the Alps of France and Switzerland and the north of France.

The sub-var. *calabrica* has also an inflated base; aperture slightly descending.

The sub-var. *shuttleworthiana* is described as more strongly striate above, the whorls more rounded, and the last smaller than in typical *obscurata*, and has a diameter of 17 mill., and an altitude of $5\frac{1}{4}$ mill.

The sub-var. *cloacarum* has the last whorl more swollen beneath, and the columellar margin more strongly arched than in the sub-var. *blautneri*; diameter, 16 mill.; altitude, 6-7 $\frac{1}{2}$ mill.



FIG. 47.—*H. lucida* var. *obscurata* Porro (after Moquin-Tandon).

GERMANY.

Sub-var. *septrionalis*, in the palm-house at Frankfurt-am-Main in Nassau, and Cologne in Rhenish Prussia (Clessin, Ung. und Schweiz, 1887, p. 74).

FRANCE.

Alpes Maritimes—Sub-var. *blauveri*, recorded from the submarine zone at Mentone by Nevill; for Nice and Cannes by Bourguignat; and the sub-var. *compressa* is recorded from Nice by Dumont and Mortillet.

Aude—Sub-var. *septrionalis*, recorded by P. Fagot as widely distributed about Mount Alarie.

Ain—Sub-var. *blauveri*, Blanaz; at Hauteville there is a small form which may be called *minor*; sub-var. *septrionalis*, Bellegarde, also from Hauteville and the flanks of Colombier (Locard, Moll. Ain, 1881, p. 23).

Aisne—Sub-var. *septrionalis*, recorded by P. Fagot.

Bouches-du-Rhône—Sub-var. *blauveri* found by Bourguignat on the Isle of Chateau d'If near Marseilles.

Côte d'Or—Sub-var. *septrionalis*, recorded by Beaudouin.

Drôme—Sub-var. *septrionalis*, recorded by Beaudouin.

Gard—Var. *obscurata*, Arlinde and Quissac; the sub-var. *blauveri*, Fumades (Clement, Moll. Gard, 1878, p. 4).

Hautes Pyrénées—Sub-var. *blauveri*, recorded for Lourdes by P. Fagot.

Hérault—Sub-var. *blauveri*, St. Martin-de-Londres, Ganges, etc. (Dubrueil, Moll. Hérault, 1863, p. 4).

Jura—Sub-var. *septrionalis*, wood at Jouhe (Wattebled, Journ. de Conch., 1889, p. 312).

Oise—Sub-var. *septrionalis*, Forest of Compiègne near Réthondes (Bandon, Journ. de Conch., 1884, p. 226).

Pyrénées Orientales—Sub-var. *septrionalis*, recorded by Fagot as rare below Col des Frènes.

Seine—Sub-var. *blauveri*, Les Moulineaux, le Val (Pascal, Moll. Haute Loire et Paris, 1873, p. 29).

Seine et Marne—Sub-var. *septrionalis*, rather rare about Lagny, by roadsides and in Marne alluvium (Locard, Moll. Lagny, 1881, p. 11).

Var—Sub-var. *blauveri* is recorded by Bourguignat for Toulon and Hyères.

Vaucluse—Sub-var. *blauveri*, Commandant Caziot, July 1906.

Vienne—Sub-var. *septrionalis*, recorded by Caziot.

Corsica—Var. *obscurata* is recorded from Bastia, Corte, and Ajaccio; sub-var. *blauveri* from St. Florent, Ajaccio, Vico and Sartene; while sub-vars. *septrionalis* and *shuttleworthiana* are also found in Corsica.

ITALY.

Var. *obscurata* is recorded for Liguria, Abruzzi, Piedmont, Calabria, Tuscany, and the islands of Sardinia and Sicily; sub-var. *planulata* for Piedmont by Stabile; sub-var. *calabrica* from Calabria by Marchioness Paulucci; sub-var. *porroi* from Sardinia; sub-var. *septrionalis* from North Italy; sub-var. *blauveri* from Emilia and the Apuan Mountains, Tuscany; and sub-var. *cloacarum* from Volterra in Tuscany.

AUSTRO-HUNGARY.

Sub-var. *septrionalis*, Buda-Pesth, Hungary (Clessin, l.c.); sub-var. *blauveri* from Görz.

SPAIN.

Var. *obscurata* is recorded from the Alhambra, Granada, by Rosenhauer; sub-var. *blauveri* from Seville; sub-var. *septrionalis* is said to be common in many localities in Catalonia; sub-var. *navarrica* is recorded by Servain from Catalonia, and from Pamplona, Fuenterrabia, and the Valley of Aran in Navarre. Sub-var. *subglabra* is given by Servain as from Granada and Seville in Andalusia.

NORTH AFRICA.

Morocco—Sub-var. *blauveri*, Tangiers, J. H. Ponsonby (Pallary, Mal. N.-O. Afrique, 1898, p. 60).

Var. *navarrica* Bourg., Rev. et Mag. Zool., 1870, p. 20, pl. 16, ff. 10–12.

Zonites navarricus Bourguignat, op. cit.

SHELL smaller, smoother, glossier, with more slowly increasing whorls and more convex base, without the usual basal whiteness.

FRANCE.

According to Gourdon, it is found on the rocks near the Castle of Bramevaque, Hautes Pyrénées (Moll. Barousse, 1890, p. 228). It is also recorded from Western France by Kobelt, and from the Forest of Compiègne in the department of the Oise by Baudon.

SPAIN.

Guipuscoa in the Basque provinces and in the Pyrenean Mts. (Bourg., l.c.).

NORTH AFRICA.

Algeria—Algiers (Westerlund, Paläarkt. Binnen Conch., 1886, p. 56).

Var. *convexiuscula* Req., Cat. Moll. Cors., 1848, p. 45.

Helix blauneri var. *convexiuscula* Req., l.c.

Zonites farinesianus Bourg., Rev. et Mag. Zool., xxii., p. 18, pl. 16, ff. 1-3.

Hyalina draparnaldi v. *elata* Borcharding, Mal. Bl., 1881, p. 1, pl. 1a—c.

SHELL with a more elate and convex spire than the type.

The var. *convexiuscula* sensu stricto has a more convex spire, a little wider umbilicus, and is a somewhat larger shell than the typical form.

The sub-var. *farinesiana* has a convex spire and narrower whorls, with the base declining towards the umbilicus, and measures 15 mill. in diameter and 7 mill. in altitude.

The sub-var. *elata* is described as having but two perfect laterals and a bifid endocone to the third lateral tooth of the radula, which, if proved to be correct, affords grounds for many interesting speculations. The shell itself is darker, glossier, more striolate, and more elevated.

Diam., maj. 13.5 mill; min. 13 mill. Aperture, 7 mill. long; 6 mill. high.

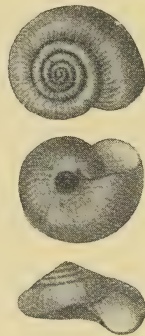


FIG. 48.—*H. lucida* var. *elata* (after Borcharding).

GERMANY.

Hanover—Sub-var. *elata*, abundant in the Moat, Osnabrück, Oct. 1879 (Borcharding, op. cit.).

Lippe—Sub-var. *elata*, on the Büchenberg, Detmold, 1880 (Borcharding, op. cit.).

Nassau—Sub-var. *elata*, Frankfurt-am-Main, O. Goldfuss (Borcharding, op. cit.).

FRANCE.

The sub-var. *farinesiana* is recorded by Tryon from Brittany and Provence.

Hérault—Var. *convexiuscula* s.s., throughout Hérault (Dubrueil, Moll. Hérault, 1863, p. 4).

Haute Loire—Var. *convexiuscula* s.s., roadside ditches, etc., about Puy (Pascal, Moll. Haute Loire, etc., 1873, p. 29).

Seine—Var. *convexiuscula* s.s., around Paris, at Arcueil, Bourg-la-Reine, St. Denis, Orsay, Longjumeau, Meudon, Versailles, etc. (Pascal, l.c.).

Corsica—Var. *convexiuscula* s.s., Bastia, Corte, and Ajaccio (Requien, Moll. Corse, 1845, p. 45).

SPAIN.

Catalonia—Sub-var. *farinesiana*, recorded from Valley of Ribas by Bofil y Poch, and a small form of the same, named *minor* by Manuel de Chia, and said to scarcely differ from *H. cellaria*, is found beneath stones in damp and shady places of the Dehesa, S. Pons, S. Julian de Ramis and S. Daniel in the comarca de Gerona.

Var. *requienii* Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 76.

SHELL very depressed with a somewhat distinct keel, umbilicus a little wider.

Corsica—St. Florent, Bastia, Bonifacio, and Vico (Moquin-Tandon, l.c.).



FIG. 49.—*H. lucida* v. *requienii* Moq. (after Moquin-Tandon).

Var. *syriaca* Kobelt, Rossm. Icon., 1877, vi., p. 22, f. 1585.

SHELL more solid, milk-white beneath, last whorl compressed. Aperture pearly and shining, and the illustrative figure indicating an internal rib.

Diam., maj. 17 mill. ; min. 15 mill. Alt., 7 mill.

This thicker form would seem to be a response to the arid conditions so prevalent in eastern lands.

RUSSIA.

Transcaucasia—Recorded from Mingrelia by Kobelt.

ASIA MINOR.

Syria—Recorded by Kobelt.



FIG. 50.—*H. lucida* v. *syriaca* Kobelt (after Kobelt).

Var. *albina* Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 76.

Zonites lucidus var. *selectus* Mousson, Coq. Schläfli, 1862, ii., p. 25.

SHELL white.

The var. *selecta* of Mousson, which is described as a larger and whitish form, with slightly narrower umbilicus and less impressed sutures, would seem best placed here as a passage form to the typical colouring.

Gloucester W.—St. Vincent Rocks, Clifton near Bristol ! Miss F. M. Hele.

FRANCE.

Haute Garonne—Pech-David near Toulouse (Moquin-Tandon, l.c.).

Seine—Moderately common in the gardens of the Grand Montrouge (Pascal, Cat. Moll. Haute Loire and Paris, 1873, p. 29).

SPAIN.

Andalusia—San Roque, Gibraltar ! R. D. Darbshire.

RUSSIA.

Transcaucasia—Sub-var. *selecta* has been recorded from Sukkum and Kutais on the west, and from Lenkoran on the shores of the Caspian Sea.

Var. *maculosa* Cockerell, Proc. Zool. Soc., April 1887, p. 363.

SHELL entirely beset with irregularly placed opaque white spots.

This condition is probably atavie, and apparently due to deposits of calcareous matter ; it is a transitional state between the usual translucent horny shells and the opaque calcareous ones of other genera. Pascal has observed a similar state in *Hyalinia cellaria*.

Middlesex—Isleworth (Cockerell, l.c.).

Geographical Distribution.—*Hyalinia lucida* is dispersed over the whole of Western Europe, extending also into Asia and North Africa, and is reported from several localities in North America, where it has doubtless been introduced.

It is evidently only a subdominant species, as it is most plentiful around the Central European region, within which area it is not nearly so abundant.

In the British Isles its distribution is somewhat discontinuous, and chiefly western and northern, another evidence of its decadence from an undoubted former dominancy.

The real distribution, however, is probably very inadequately known, as it was formerly and is still so frequently confused with the more abundant *H. cellaria*. Its identity is also far too commonly masked by the specific names applied by various authors to slight geographical variations, a method of procedure hindering the formulation of sound and broad generalizations, and therefore very unfortunate in its results.

FIG. 51.—Geographical Distribution of *Hyalinia lucida* (Drap.).

▨ Probable Range.

■ Recorded Distribution

ENGLAND AND WALES.

Channel Isles—Le Gouffre, Guernsey, June 1904 ! Hugh Wyndham. Mount Orgueil, and St. Helier's, Jersey, June 1905, F. H. Sikes.

Cornwall W.—Newquay, Sept. 1886 ! Truro ! and near Helston, J. H. James. Unnamed specimens in the British Museum, labelled "Falmouth, W. R. Cocks."

Devon S.—Plentiful, Torquay, Oct. 1885 ! B. M. Oakeshott. Paignton, 1885, S. C. Cockerell. Holbeton near Ivybridge (Marquand, Journ. of Conch., Oct. 1889, p. 138). Plymouth, 1891 ! F. Hughes. Drain in garden at Topsham, Sept. 1892 ! L. E. Adams. About market-gardens, Ottery-St.-Mary, Rev. G. W. Shaw.

Devon N.—Hele near Ilfracombe, Mch. 1887 ! B. Tomlin. Garden, Barnstaple, 1903 ! F. J. Partridge.

CHANNEL.

Dorset—Portland, Sept. 1893 ! F. Hughes. Swanage, Oct. 1904 ! B. Tomlin.

Hants. S.—Christchurch, 1885 ! Charles Ashford.

Hants. N.—Preston Candover, Oct. 1883 ! Rev. H. P. Fitzgerald.

THAMES.

Surrey—Richmond, "Rogers' Collection," F. H. Sikes.

Middlesex—Garden, Isleworth, April 1887 ! F. G. Fenn. South Kensington, June 1906 ! F. H. Sikes.

Oxford—Swincomb, occasional but rare (W. E. Collinge, Conch., 1891, p. 14).

ANGLIA.

Suffolk E.—Ipswich, A. E. Boycott.

Cambridge—University botanic gardens, Cambridge ! Hugh Watson.

SEVERN.

Gloucester W.—St. Vincent Rocks, Clifton, Bristol, 1880 ! Miss F. M. Hele.

Hereford—Breinton and Clehonger, but nowhere plentifully (Boycott and Bowell, Hereford List, 1899, p. 25).

SOUTH WALES.

Glamorgan—Llandaff, scarce, March 1887 ! F. W. Wotton.

Carmarthen—Near Oaklands, Carmarthen, April 1902 ! T. W. Barker. Laugharne, July 1906 ! J. Williams Vaughan.

Pembroke—Several colonies near Tenby in a damp corner of the burrows by the gasworks; Mason's coalyard; and a plantation at the bottom of Heywood lane, Tenby, Feb. 1898 ! A. G. Stubbs.

NORTH WALES.

Merioneth—Towyn, "Rogers' Collection," F. H. Sikes.

TRENT.

Lincoln N.—Welton Wood, July 1902 ! C. S. Carter.

Derby—Darley Dale, R. Standen. Winster, Rev. H. Milnes. Matlock, T. A. Howe and H. E. Craven.

Lancashire S.—In greenhouse at Middleton, May 1897 ! T. Rogers. In greenhouse at Industrial School, Swinton, Sept. 1885 ! R. Standen. Prestwich, "Rogers' Collection," F. H. Sikes.

Lancashire Mid—On the rockery of the fernery, Avenham lane, Preston, Sept. 1885 ! W. H. Heathcote.

York S.E.—Pine wood, Tibthorpe Wold, Aug. 1903 ! Rev. E. Percy Blackburn.

York S.W.—Bottoms, Heckmondwike, Sept. 1901 ! T. Castle.

Westmorland and Lake Lancs.—Grange-over-Sands ! J. W. Jackson.

Isle of Man—Stanley road, Peel, Aug. 1891 ! R. Cairns.

SCOTLAND.

Fife and Kinross—St. Andrews ! W. Evans.

Kincardine—Stonehaven, Sept. 1886 ! W. Turner.

Clyde Isles—Rothesay ! and Rothesay Castle, Bute, Sept. 1887 ! A. Shaw. Brodick, Isle of Arran, April 1906 ! F. H. Sikes.

IRELAND.

Antrim—Exceptionally large at Murlough, Sept. 1896, R. Standen. Cushendun, and at Church Bay, Rathlin Island, May 1897, L. E. Adams.

Cavan—Kilmore graveyard, July 1896, R. Welch.

Dublin—Found in Dublin by the late T. W. Warren, and since by Prof. G. V. Hart (R. F. Scharff, Irish Nat., July 1892, p. 65). Kingstown, May 1886 ! W. F. de Vismes Kane. Blackrock, Oct. 1889 ! W. A. Gain.

Kilkenny—Piltown, Sept. 1904 ! Earl of Bessborough.

King's Co.—Charleville Forest, Tullamore, Sept. 1904 ! R. McKenna.

Leitrim—Drumshanbo, Sept. 1904 ! J. W. Welch.

Galway W.—Aran Islands (R. F. Scharff, Irish Nat., July 1892, p. 65). Very fine near Kilonan, and by Clare-Galwey Abbey, July 1905 (R. Standen, Irish Nat., Sept. 1895, p. 266).

Galway E.—Clonbrock, June 1896 (R. F. Scharff, Irish Nat., Sept. 1896, p. 223).

Limerick—Limerick ! W. Hill Evans, 1884. A quarry near Limerick, and near Corbally, April 1906 ! H. J. Fogerty.

Cork N.—Tivoli near Cork, Sept. 1903 ! P. H. Grierson. Blarney Castle, June 1893 ! R. F. Scharff.

Cork S.—Garden, Ashburton, Cork ; also near Queenstown and Middleton (R. A. Phillips, Cork List, 1894).

Kerry—Valentia Island (R. F. Scharff, Irish Nat., July 1892, p. 65).

GERMANY.

This species is more plentiful in the southern than in the northern districts, but is recorded for Alsace, Baden, Bavaria, Brandenburg, Cassel, Gotha, Hanover, Hamburg, Holstein, Lorraine, Lusatia, Nassau, Osnabrück, Prussia, Saxony, Silesia, Thuringia, and Wurtemberg.

NETHERLANDS.

Holland—Reported for the provinces of Utrecht and Zeeland by Schepmann.

Belgium—Reported from the provinces of Liège, Luxembourg, and Namur.

FRANCE.

Found most plentifully in South and Central France, but exists in the mountains of the Jura and the Alps, and has been reported as inhabiting the following departments and districts:—Ain, Aisne, Allier, Alpes Maritimes, Ardennes, Ariège, Aude, Auvergne, Basses-Pyrénées, Bouches-du-Rhône, Calvados, Champagne Méridionale, Charente Inférieure, Côte d'Or, Côtes du Nord, Drôme, Doubs, Eure, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Hautes Pyrénées, Haute Savoie, Hérault, Ile-et-Vilaine, Isère, Jura, Loire Inférieure, Maine-et-Loire, Meuse, Meurthe-et-Moselle, Morbihan, Nièvre, Oise, Pas-de-Calais, Pyrénées Orientales, Rhône, Sarthe, Savoy, Seine, Seine Inférieure, Seine-et-Marne, Seine-et-Oise, Somme, Var, Vaucluse, Vendée, Vienne, Vosges, and the Island of Corsica. The *H. subglabra* is recorded for Morbihan, Finistère, and Côtes du Nord.

SWITZERLAND.

H. lucida is recorded from the cantons of Aargau, Berne, Geneva, Grisons, Lucerne, Neuchâtel, St. Gall, Thurgau, Uri, and Vaud. *H. subglabra* is recorded by Bourguignat for the cantons of Lucerne and Uri.

Distribution of *Hyalinia lucida* (Drap.).

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
1 Cornwall W.	41 Glamorgan
2 Cornwall E.	42 Brecon
3 Devon S.	43 Radnor
4 Devon N.	44 Carmarthen
5 Somerset S.	45 Pembroke
6 Somerset N.	46 Cardigan
CHANNEL	NORTH WALES
7 Wilts N.	47 Montgomery
8 Wilts S.	48 Merioneth
9 Dorset	49 Carnarvon
10 Isle of Wight	50 Denbigh
11 Hants S.	51 Flint
12 Hants N.	52 Anglesey
THAMES	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
15 Kent E.	55 Leic. & Rutld.
16 Kent W.	56 Notts.
17 Surrey	57 Derby
ANGLIA	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lan'shire Mid
21 Middlesex	HUMBER
22 Berks.	61 S.E. York
23 Oxford	62 N.E. York
24 Bucks.	63 S.W. York
25 Suffolk E.	64 Mid W. York
26 Suffolk W.	65 N.W. York
SEVERN	TYNE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Hunts.	69 Westmorland
32 Northampton	and L. Lanes.
33 Gloucester E.	70 Cumberland
34 Gloucester W.	71 Isle of Man
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	83 Aberdeen N.
73 Kirkcudbright	84 Banff
74 Wigtown	85 Elgin
75 Ayr	86 Easternness
76 Renfrew	W. HIGHLANDS
77 Lanark	87 Westernness
E. LOWLANDS	88 Main Argyle
78 Peebles	89 Dumbarton
79 Selkirk	90 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Pth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

ITALY.

Recorded for the provinces of Lombardy, Piedmont, Emilia, Tuscany, Umbria, the Marches, Rome, Campania, Calabria, and the Islands of Sicily, Sardinia, and Malta.

AUSTRO-HUNGARY.

Recorded as actually existing in Austria, Bosnia, Carniola, Croatia, Dalmatia, Galicia, Gorz, Styria, and Tyrol, and as probably to be found in Carinthia.

SPAIN AND PORTUGAL.

Spain—Reported from Andalusia, Castile, Valencia, Catalonia, Teruel, and the Balearic Isles. *H. subglabra* is recorded from Spain by Westerlund.

Portugal—The *H. cellaria*, described by Morelet as more deeply coloured and possessing a whorl or a whorl and a half more than specimens from more northern countries, are more probably referable to *H. lucida*.

SCANDINAVIA.

Sweden—Dr. Westerlund records this species from Calmar and Lund in the south of Sweden and from the Island of Gothland in the Baltic Sea.

RUSSIA.

Transcaucasia—Var. *syriaca* is recorded from Mingrelia, and the var. *selecta* from Sukkum, Kutais, and Lenkoran.

ATLANTIC ISLES.

Madeira—Recorded by Rev. R. T. Lowe (G. K. Gude).

NORTH AFRICA.

Morocco—Onazzan, J. H. Ponsonby; and Tetuan, A. Morelet.

Algeria—(G. K. Gude, 1906).

ASIA.

Asia Minor—Found in Armenia according to Issel, and recorded for Smyrna and Reduktaleh by Von Martens.

Persia—(G. K. Gude, Journ. of Malacology, Sept. 1902).

Cashmere—Pangal Range (Theobald f. G. K. Gude).

NEARCTIC REGION.

Washington—Greenhouses, etc., Seattle (Pilsbry, Nautilus, Meh. 1898, p. 129).

Pennsylvania—In greenhouses, etc., Lincoln Park, Philadelphia (F. C. Baker, Nautilus, 1901, p. 49); and in greenhouses, Pittsburgh, G. H. Clapp, Nov. 1902.

District of Columbia—Washington, in greenhouses, G. H. Clapp, Nov. 1902.

California—In gardens and flower beds at Oakland, H. Hemphill (Stearns). Abundant in San Francisco (Wood, Nautilus, 1894, p. 34).

Oregon—G. H. Clapp, Nov. 1902.



FIG. 52.—The Zig-zag, St. Vincent Rocks, Clifton near Bristol, one of the first recorded habitats of *Hyalinia lucida* in the British Isles.

Hyalinia cellaria (Müller).

- 1774 *Helix cellaria* Müller, Verm. Hist., ii., p. 28, no. 230.
 1789 — *nitida* Razoumowsky, Hist. Nat. Jorat, p. 275.
 1803 — *lucida* Montagu, Test. Brit., p. 425, pl. 23, f. 24.
 1807 — *nitens* Maton and Rackett, Trans. Linn. Soc., viii., p. 198, pl. v., f. 7.
 1817 — *glaphyra* Say, Nicholson's Encycl., iv., pl. 1, f. 3.
 1854 — (*Lucilla*) *cellaria* Lowe, Proc. Zool. Soc., p. 177.
 1868 — *sydneyensis* Cox, Monog. Austral. Land Shells, p. 9, pl. ix., f. 16, and pl. xviii., f. 3, 3a.
 1815 *Vortex cellaria* Oken, Lehrb. Nat., iii., p. 314.
 1833 *Oxychilus cellarius* Fitzinger, Syst. Verz., p. 100.
 1837 *Polita cellaria* Held, Index Moll., p. 6.
 1820 *Zonites lucidus* Leach, Syn. Moll., p. 75.
 1855 — (*Aplostoma*) *cellarius* Moquin-Tandon, Hist. Moll., ii., p. 78, pl. ix, f. 12.
 1862 — *cellarius* Jeffreys, Brit. Conch., i., p. 159.
 1858 *Helicella cellaria* Bellars, Illustr. Catal. Br. Shells, p. 16, pl. ii., f. 26.
 1871 *Hyalina (Euhyalina) cellaria* Kobelt, Catal. Eur. Binnenconch., p. 4.
 1876 — *cellaria* Weinland, Weichth. Schwab. Alb., p. 33.
 1877 *Hyalinia cellaria* Westerlund, Faun. Eur. Moll. Extram., p. 19.
 1886 *Euhyalina cellaria* Esmark, Journ. of Conch., v., p. 126.
 1891 *Vitrea (Polita) cellaria* Smith, Journ. of Conch., vi., p. 339.



Emile André

HISTORY.—*Hyalinia cellaria* (*cellaria*, inhabiting cellars) was first described by Müller, and his name has always been accepted as distinguishing the depressed and glassy species which goes under that name.

Considerable confusion has, however, prevailed on account of the close similarity to certain other species, with one or other of which it is still frequently confused, and it is only in very recent years that *H. lucida*, with which it was so long united by the conchologists of this country, was frankly accepted as sufficiently distinct to be accorded specific rank, and this is not by any means the only species with which it has been confused in the past.

The present species is dedicated to Dr. Emile André, Professor in the University of Geneva, whose researches into the dermal histology of this species have been so remarkable and original in their results.

The group is undoubtedly an exceedingly difficult one in which to correctly appreciate the specific characters, which blend together so gradually and imperceptibly that it is often difficult to draw satisfactory lines of demarcation.

Many of the American descriptions and records of this species are very confusing and conflicting, but show that both *H. lucida* and *H. cellaria* are found on that continent; yet their differences were not at one time fully appreciated. Binney and Bland's description of the shell and the dentition of *H. cellaria* would seem to apply to *H. lucida*, although

Binney's more recent figure, given in the Proc. Acad. Nat. Sci. Philad., in 1875, would appear to be that of the true *cellaria*. The figure given by Morse and reproduced by Binney as representing the dentition of *H. cellaria*, is apparently not from the radula of that species, but more probably belongs to *H. lucida*.

Diagnosis.—Though *Hyalinia cellaria* is very near to *H. lucida*, it is in its typical condition very distinct, and may be distinguished from that species by its smaller size, fewer volutions, flatter spire, more impressed sutures, and its more delicately-tinted and thinner shell; the aperture is also more flattened basally and more perpendicular to the axis of the shell.

The ANIMAL is pale grey, slightly darker on back and head, with paler foot-sole; the mantle-margin is speckled with a dark fawn colour, and differing markedly from *H. lucida*, in which the mantle-margin is never spotted, and in which the body is always so dark.

INTERNALLY, the visceral chain of ganglia does not display the striking obliquity shown by *H. lucida*, and the approximation of the constituent ganglia is more pronounced; the conjoined penis-sheath and epiphallus is shorter and more uniform in calibre, somewhat scimitar shaped, and without the characteristic twist seen in *lucida*; the radula shows only two true laterals at each side, the third being transitional.

Description.—ANIMAL slender, blackish-grey above, and finely granulated, with a row of comparatively large and prominent tubercles down the middle of the back bounded by the well-marked DORSAL GROOVES; sides paler, translucent grey, with coarser granulation below and behind the LATERAL GROOVES; MANTLE of a somewhat whitish-grey, except at the collar, around the RESPIRATORY ORIFICE, where it is irregularly and densely spotted with a dark fawn colour, which shows through the shell as a broad and gradually darkening margin towards the aperture; OMMATOPHORES long and slender, distinctly bulbous at the ends, and showing the RETRACTORS as a darker core; LOWER TENTACLES short and translucent-grey; FOOT slender, pointed behind, SOLE indistinctly tripartite, PEDAL GROOVES united at the tail above a longitudinal mucus-pore.

H. cellaria also, according to Dr. André, presents a peculiarity not yet noticed in other species, and of which the function is as yet unknown; this consists of about one hundred crypts or depressions on the right side of the body, but limited to the region between the genital orifice and the mouth, becoming fewer towards the dorsum. These invaginations of the external epithelium may be simple, ramified, or expanded, but generally contract at the external orifice, and have an extreme depth of a quarter to one-third of a millimetre, that is about half the thickness of the body-wall; their epithelial cellules are double the usual length and without vibratile cilia. The finely-granular structureless tissue beneath is thicker than the epithelium, and is said to be peculiar to *Hyalinia*, and is slightly stained by carmine.

In crawling, the shell is usually carried inclined to the right side, and the tail of the animal does not extend quite to the margin of the shell.

MUCUS thin, colourless, and slightly iridescent.

SHELL very depressed and almost discoid, more convex beneath, thin and brittle, very glossy, smooth, and semitransparent, of an amber or yellowish-horn colour above, and whitish, with often a greenish or bluish tinge around the umbilicus, which is comparatively narrow, but deep and slightly overspread by the apertural margin; LINES OF GROWTH shallow and indistinct, slightly puckered at the sutures and microscopically striate in a spiral direction; SUTURE with a channeled aspect and showing often as a darker line; EPIDERMIS comparatively thick; WHORLS 5-6, regularly but slowly increasing; SPIRE slightly raised; APERTURE broadly lunate, and slightly oblique, with simple and direct margins, the basal margin slightly reflected over and encroaching on the umbilicus, the upper margin projecting beyond the lower.



FIG. 54. — Section through right moiety of body of *H. cellaria* showing "crypts" and location of phylacoblcasts $\times 10$ (aft. André). *bc.* body cavity; *c.* crypts; *m.* mantle; position of phylacoblcasts are indicated by black cells on dorsum.

When containing the retracted animal, the shell on the upper side appears of a dark dusky-brown at the apex, gradually paling and scarcely differing from the pale horn colour of the shell substance except near the aperture, which shows a broad and faintly darker margin; the underside is pale up to the triangular and yellowish renal organ, but is afterwards dark-brown, with two very slender and parallel whitish streaks, which are faintly continued on the upper side also.

Diam., maj. 10 mill. ; min. 8 mill. Alt., 5 mill. Average weight, $\frac{1}{2}$ grain.

INTERNALLY, the NERVE-COLLAR is more symmetrical than in *H. lucida*, owing to the pleuro-abdominal commissures being more equally developed; the right pallial GANGLION is, however, conspicuously larger than its fellow on the left side; the SUPRA-ŒSOPHAGEAL GANGLIA have slender dark grey commissures; the BUCCAL GANGLIA are separated by about their own diameter, and their neurilemma is pigmented, as are also the commissures; the HEART is colourless or light grey, the ventricle somewhat larger than the auricle; the pyriform but somewhat incon-

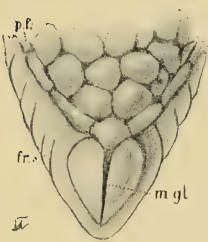


FIG. 55.



FIG. 56.

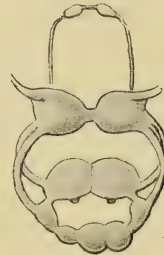


FIG. 57.



FIG. 58.

FIG. 55.—The caudal aspect of *Hyalinia cellaria*, contracted after scalding, to show the mucus cavity, and incidentally the rugosities of the body, the fringe and the peripodial groove, $\times 16$. fr. fringe; m.gl. caudal mucous gland; p.f. peripodial furrow.

FIG. 56.—Arrangement of the internal organs of *H. cellaria* as seen from beneath, $\times 8$.

a. auricle; l. liver or digestive gland; o. ovotestis; st. stomach; r. renal organ; v. ventricle.

FIG. 57.—Nerve ring of *H. cellaria*, showing the buccal ganglia and otocysts, $\times 12$.

FIG. 58.—Heart and renal organ of *H. cellaria*, $\times 6$. a. auricle; v. ventricle; k. kidney.

spicuous RENAL ORGAN or kidney is of a light-cream colour or pale buff and very faintly streaked, the rectum running as usual along its left margin; the PEDAL-GLAND is well-developed, but anteriorly the groups of gland cells are separated by many blood sinuses, while posteriorly the gland is compact; the EXCRETORY CANAL has distinct longitudinal ribs and groove, while on the roof there is a single fold containing a blood sinus.

The CEPHALIC RETRACTORS spring from the powerful columellar muscle, and arise from separate roots; the PHARYNGEAL retractor originates far back, and only expands and very slightly bifurcates for attachment to the BUCCAL BULB; the TENTACULAR muscles divide as usual, sending branches to the lower tentacles, and the point of origin of the right tentacular muscle is slightly anterior to its fellow on the left side.

The ALIMENTARY SYSTEM has a narrow and dusky-coloured ŒSOPHAGUS, striped with white, with broadly-oval and slightly united pale SALIVARY GLANDS, widening beyond into the long, brownish, subcylindrical pouch or crop, and blending with the STOMACH, which is as usual at the bend where the bile-ducts enter; the INTESTINE is rather broad on leaving the stomach, but narrows gradually, its greenish-grey or lavender tint rendering its flexures very conspicuous in contrast with the loosely lobulated buff-coloured or brownish LIVER or digestive gland.



FIG. 59.



FIG. 60.

FIG. 59.—Cephalic retractors of *H. cellaria*, $\times 4$. (Christchurch, Mr. C. Ashford).

FIG. 60.—Alimentary canal of *H. cellaria*, $\times 6$. (Christchurch, Mr. C. Ashford).

The REPRODUCTIVE ORGANS show a light brown or whitish, slightly coherent OVOTESTIS; the HERMAPHRODITE DUCT is thickest in the middle with opaque-white spots and specks, and is slightly convolute proximally, terminating in a simple VESICULA SEMINALIS; ALBUMEN GLAND linguiform, semitransparent, yellowish or reddish-amber, occasionally tinged with brown or green; OVIDUCT narrow above, more ample below, and comparatively broader than in *H. lucida*; SPERM-DUCT or prostate opaque cream colour, and very conspicuous, of granular appearance, and variable width; SPERMATHECA usually broadly oval, with reddish or purplish core, united to the oviduct by the muscle at the crown; in younger animals the VESICLE is more elongate; the DUCT or stem is about double the length of the vesicle,

doubly flexed, and gradually widening below; in its natural position the duct lies across the free-oviduct, and one side of the vesicle is attached to the base of the oviduct, concealing the point of separation of the sperm-duct; FREE-OVIDUCT long and thick; VAGINAL GLAND cream coloured or yellowish, surrounding the oviduct and base of the spermatheca-duct; VAS DEFERENS very slender, but after passing through the muscular filaments, binding the base of the penis-sheath, it abruptly enlarges and

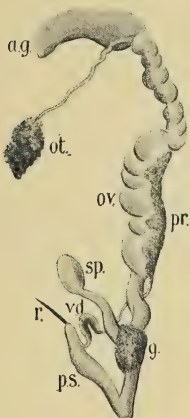


FIG. 61.

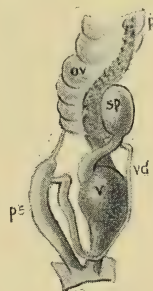


FIG. 62.



FIG. 63.

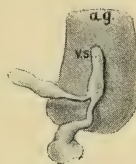


FIG. 64.

FIG. 61.—Reproductive organs of *H. cellaria*, $\times 3$.

ag. albumen gland; *g.* vaginal gland; *ot.* ovotestis; *ov.* oviduct; *pr.* prostate or sperm-duct; *ps.* penis-sheath, with distal epiphallus; *r.* penial retractor; *sp.* spermatheca; *vd.* vas deferens.

FIG. 62.—Proximal end of the sexual organs of *H. cellaria*, illustrating the relative positions naturally occupied by the various organs during life, $\times 5$.

ov. oviduct; *ps.* penis-sheath and distal epiphallus; *sp.* spermatheca; *v.* vaginal gland; *vd.* vas deferens.

FIG. 63.—Enlargement of distal or epiphallial end of penis-sheath of *H. cellaria*, showing structure as seen by transmitted light, $\times 6$ (after a photo. by Mr. W. Moss).

FIG. 64.—Base of the albumen gland showing the vesicula seminalis and its mode of junction with the ovipermatoduct and hermaphrodite duct in *Hyalinia cellaria*, $\times 6$.

vs. vesicula seminalis; *ag.* albumen gland.

forms a white, elongated expansion or lumen, ornamented by a series of opaque milk-white streaks, and diminishing gradually in calibre as it approaches the penis-sheath, but the enlarged section is nearer the latter organ than it is in *lucida*, and discharges nearer the free-end of the epiphallus, to which it is fused for a short distance; the EPIPHALLUS is slightly fusiform, and is internally ridged and also beset with two or more longitudinal rows of rounded depressions, the junction with the penis-sheath being indicated by an indistinct constriction; the PENIS-SHEATH is slightly but gradually widened below, but there is no indication of the marked and abrupt contraction at the junction with the vestibule, which is so conspicuous in *H. lucida*, the combined organ is naturally curved, somewhat like a scimitar, and is of a pearly-white colour, with opaque-white streaks and spots; the long and filiform PENIAL RETRACTOR is terminal and attached to the upper section of the oviduct; VESTIBULE or atrium short.

The MANDIBLE or jaw is of the usual crescentic type, of dark amber colour, becoming deep brown in the thicker parts, and nearly a millimetre across; it is strongly arcuate from front to back, with bluntly rounded but somewhat falciform ends; concave cutting margin with a broad and prominent median projection or beak; in the specimen figured the line of insertion in the tissues is cleft in the centre.

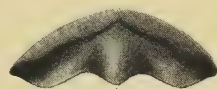


FIG. 65.—Mandible or jaw of *H. cellaria*, $\times 20$.

(Christchurch, Mr. C. Ashford).

The LINGUAL RIBBON is nearly three mill. long, and of the usual oblong shape, generally composed of about thirty-three arcuately transverse rows of teeth, each row formed by a small tricuspid median tooth, cramped between two noticeably

larger admedian or lateral teeth, each with three irregularly disposed cusps or cutting points, beyond which there is a transition tooth which, though still retaining the mesocone and endocone, has frequently lost the ectocone; the remaining teeth are strictly aculeate, and diminish rapidly in size towards the margins of the membrane.



FIG. 66.—Transverse row of teeth from the odontophore of *H. cellaria*, $\times 150$. The animal collected at Christchurch, Hants., by Mr. C. Ashford, and the palate prepared by Mr. J. W. Neville.

The formula of a Christchurch specimen is

$$\frac{11}{1} + \frac{1+2}{2 \cdot 3} + \frac{1}{3} + \frac{2+1}{3 \cdot 2} + \frac{11}{1} \times 35 = 1,015.$$

Reproduction and Development.—Little or nothing is known of the congress and development of this very abundant species beyond that the pairing time probably extends over almost the whole year, as eggs have been observed to be deposited as early as February and also in August, and that the male element is transferred during pairing by means of a spermatophore. The eggs, which number thirty to forty, and rarely fifty, are deposited singly; they are spherical and dull white in colour, enclosed within a calcareous envelope, and are about one-and-half mill. in diameter. They hatch in fifteen or sixteen days, the young attaining maturity at the commencement of the second year.



FIG. 67.—Spermatophore of *H. cellaria*, $\times 10$ (after a photo. by Mr. W. Moss).

Food and Habits.—*H. cellaria* secretes a large quantity of thin slime, and is a very shy and inactive animal during the day, when it may be found hiding beneath stones, at the foot of or in the crevices of walls, amongst almost any kind of refuse or hidden under dead or decaying leaves in hedgerows, and has even been found in gardens in early spring at a depth of eight to ten inches beneath the surface. It especially frequents dark cellars, vaults, damp outbuildings, yards, and other places about human dwellings, penetrating into and even thriving in such abodes, quite in the heart of the largest cities.

At dusk it becomes more active, and then emerges from its place of concealment, and feeds upon the cryptogamic vegetation which flourishes in damp and darkness. *H. cellaria* is, however, by no means restricted to this diet, but will crawl into milk-bowls, presumably to partake of their contents, and is also actively predacious, having been observed in the act of devouring small worms. They have also a particular relish for the eggs of *Arion ater*, and will even burrow down to them when they are buried beneath the surface of the soil. They will also attack and devour other mollusks, and Van-den-Broeck records *Helix fasciolata* as one of the species which readily falls a victim to their attacks.

About Tenby Mr. A. G. Stubbs has observed that this species has a decided preference for the common "Alexanders" (*Smyrnium olusatrum* L.), whose large leaves keep the ground at the base of the plant cool and moist.

On the continent it is noted as almost alpine in its habits, occurring in Savoy only above the zone of the vine, and ascending up to nearly 4,000 feet; in the Pyrenees it lives in the zone of *Helix limbatu*, at an altitude between 3,500 and 5,000 feet.

Though possessing so frail a shell and so delicate an epiphragm, this species can brave with impunity such severe frosts that *Helix nemoralis* and *H. hortensis* submitted to the same conditions invariably perish.

The average rate of progression of *H. cellaria* when crawling on a smooth surface has been established as nearly two inches per minute or at the rate of a mile in rather less than twenty-two days.

The vertical lines connect the corresponding points of temperature and pulse rate.

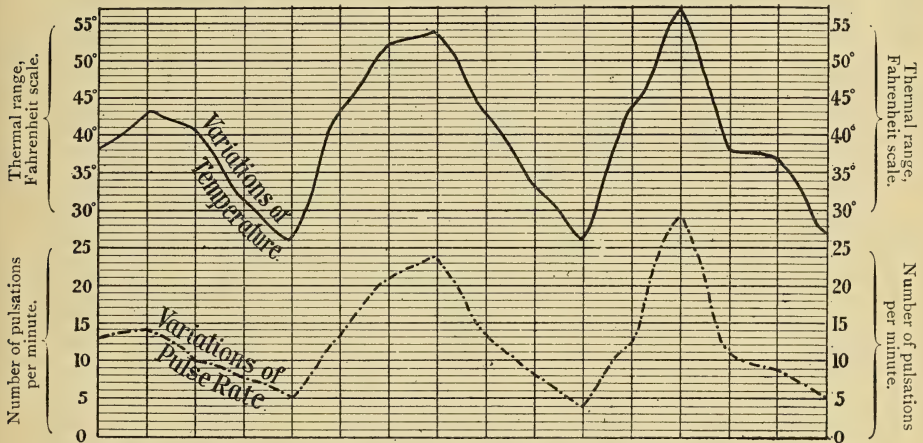


FIG. 68.—Diagram of the pulsations of the heart of *Hyalinia cellaria*, illustrating the correlation of its activity with the changes of temperature.

The susceptibility of the heart's action to changes of temperature varies somewhat in different individuals, but is also influenced by age, health, and probably by other causes, whose action is not yet appreciated, and which may possibly account for certain discrepancies now observed. The illustrative diagram of the correlation of temperature and heart-pulsation represents the results of a large number of observations by the late Mr. Charles Ashford and myself.

Parasites and Enemies.—*H. cellaria* in spite of its retiring habits, is greatly preyed upon by thrushes, blackbirds, and starlings, and the shells may be found quite perfect in their crops.

Internally, they are also liable to be infested with a long and filiform parasitic worm, which has not yet been identified.

Geological History.—*Hyalinia cellaria* has been reported from many deposits of Pleistocene and Holocene age, both in this country and abroad.

PLEISTOCENE.—It is recorded by Morris from the Upper Pleistocene beds at Harwich, Clacton, and Copford in North Essex. In Cambridgeshire, Mrs. McKenny Hughes reports it from the gravel pits about Barnwell Abbey and Grantchester; while Mr. A. Santer Kennard informs me that it is abundant in the Ightham fissure in West Kent, where the specimens vary greatly in the height of spire. It has also been found at Hoxne in East Suffolk; in the Happaway Cavern, Devonshire; at Newquay in Cornwall; and in Kesh Cave, co. Sligo, Ireland.

In Germany, it is recorded from Schwansbeck near Halberstadt in Prussian Saxony, and Sandberger records it as found commonly in the Upper and Middle Pleistocene tufaceous-deposits at Weimar, Burgtonna,

and also at Muhlhausen in Thuringia. It is also stated to have been found in the Mid Pleistocene Valley loess of Oberweiler, near Rastadt in Baden, and in the Pleistocene tufaceous deposits near Regensburg, Bavaria.

In France, Mons. A. Locard reports it from the Upper Pleistocene beds at Santenay, Côte d'Or.

In Denmark, it is reported by Mr. A. Santer Kennard as obtained from a kitchen-midden at Meilgard.

In Italy, it is recorded by Issel from the breccia of probably Pleistocene age at Spotorni and Verzi in Western Liguria.

HOLOCENE.—In Devonshire, this species is said by Mr. Santer Kennard to be found in deposits at Dawlish; and has also been reported by Mansel-Pleydell from the tufaceous beds at Blashenwell, Dorset. In the Isle of Wight, Prof. Forbes recorded it from the lacustrine beds at Totland's Bay near Yarmouth; Mr. Kennard from a Neolithic rainwash on St. Catherine's Down; and Mr. Loydell from drift at Ventnor station intermixed with rounded flints and phosphatic nodules from a lower zone. In Sussex, it has been found at Eastbourne and at Cissbury. In Kent, it was collected by the Rev. R. Ashington Bullen in the deposit overlying the head or rubble drift at Barton Court, Buckland near Dover; while Mr. Kennard records it from the base of a rainwash, two to six feet thick, at Darenth, as well as from Maidstone, Charing, Otford, Exedown near Wrotham, and Charlton. In Surrey, it has been found by the Rev. R. Ashington Bullen in a Neolithic deposit at Reigate, and also in the Horseshoe deposit at Colley Pit near the same town; and Mr. Kennard records it for Walton Heath and Bermondsey. In Middlesex, it was found in the section disclosed by the excavations for the Admiralty Buildings at Westminster, and has also been collected at London Wall. In Essex, it has been recorded from the deposits at East Tilbury, Crossness, Shalford, Roxwell, and Walthamstow; by Mr. French from alluvial shell-marl at Felstead; and has also been found commonly in the black earth and peat, and rarely in the shell-marl at Chignal St. James by Miller Christy. Mr. Kennard also reports its occurrence in the beds at Cleeve Hill and Westbury-on-Severn in Gloucestershire. In Nottinghamshire, Mr. C. T. Musson found it in the black earth at Gotham Moor and also at Grass-thorpe; and Dr. H. H. Corbett in the old lake deposit at Askern, near Doncaster, Yorkshire.

In Ireland, it has been found in deposits at Cloughan Point, Belfast, co. Down; Templeogue, co. Dublin; the Warren, Achill Island, Mayo West; Dog's Bay, Galway West; in the marl deposit at Marlfield, near Clonmel, South Tipperary; at Drumcliffe Craunoge, co. Clare, where the specimens are said to attain fifteen mill. in diameter; and Mr. R. Welch has found them in shell-pockets on the sand-dunes in many Irish counties.

In France, it is recorded from the "brèches osseuses," near Bagnères-de-Bigorre, Hautes Pyrénées, at an altitude of about 3,600 feet.

In Belgium, it is common in the Tourbe, Uccle lez-Bruxelles; it has been found at Mons in Hainault, also in the alluvium of the Valley of Dendre by Lecomte, and in the "Ossements quaternaires" at Saint-Gilles-Bruxelles, by Delheid.

In Germany, a slightly larger form of the var. *sieversi* Böttger (diam. $8\frac{1}{2}$ mill.) has been found in a subfossil state at Schalkau in Thuringia.

Variation.—All the species of this group have but a restricted scope for variation; in addition to the modifications of shape and size, the white basal coloration may extend over the whole of the shell, or on the contrary the shell be entirely more or less fawn-coloured.

In very dry situations the shells are said by Macgillivray to be noticeably thicker, firmer, and more opaque; while in the moister localities the shells are often of a yellowish-brown colour and so very thin as to be a mere film. After death, if exposed to the weather, the shells soon become of an opaque-white and very brittle.

In the west and north there is apparently a larger but more ancient and weaker race of this species, which forms a still closer connecting link with *Hyalinia lucida*, from which it is often very difficult to separate it by external characters; the anatomy of these somewhat dubious forms is, however, undoubtedly that of *H. cellaria*, and they may be referable to the var. *compacta* of Jeffreys.

It is quite probable that the *H. villæ* of Mortillet is also only a form of the present species, with which its radula closely coincides, and with which it has frequently been allocated. *H. chersa*, *H. sancta*, *H. intermissa*, and other forms have also been referred to *H. cellaria* by many authors.

VARIATIONS IN SHELL.

Var. *compacta* Jeffreys, Brit. Conch., 1862, i., p. 160.

Zonites cellarius var. *compacta* Jeffreys, l.c.

Zonites cellarius v. *silvatica* Mörch, Syn. Moll. Dan., 1864.

Zonites cellarius elevatus Van den Broeck, Ann. Soc. Mal. Belg., 1869, p. 87, pl. 2, f. 4.

SHELL not so white underneath; whorls more convex; and spire more prominent.

This variety, which according to Westerlund is identical with the var. *silvatica* of Mörch, may be regarded as embracing the large convex *cellaria*, which by their deeper colouring, convex spires, and large size, simulate *H. lucida*. Dr. Jeffreys himself regarded this variety as really including our *H. lucida*. It is evidently a transition form between *H. lucida* and *H. cellaria*, having the internal structure of *cellaria*, but a superficial resemblance externally to the true *lucida*, while its discontinuous northerly and westerly distribution in this country stamp this form as one of the weaker races which will be eventually exterminated.

The sub-var. *silvatica* differs in the aperture being surrounded by a thin whitish internal rib. Diam., 11–13 mill.; alt., 5–6 mill.

The sub-var. *elevata* is described as very convex above, with oblique but not compressed aperture. Diam. 13 mill.; alt. 6 mill.



FIG. 69.—*H. cellaria* v. *elevata* Van den Broeck (after Van den Broeck).

ENGLAND AND WALES.

Somerset S.—A somewhat flatter form, Dulverton, 1903! Hugh Watson.

Isle of Wight—Carisbrooke, July 1869 (Lecomte, Bull. Soc. Mal. Belg., 1869, p. 61).

Surrey—Box Hill, 1883, A. Loydell. Croydon (Kenneth McKean, Proc. Croydon Nat. Hist. Club, 1883, p. 151).

Cambridge—Stapleford! Hugh Watson.

Gloucester W.—Stroud, May 1885! E. J. Elliott.

Worcester—Hay Mills near Birmingham, 1870, W. Nelson.

Warwick—Cellars, Digbeth, Birmingham, 1870! W. Nelson.

Stafford—Wren's Nest, Dudley, 1870, W. Nelson.

Salop—Porthynaen Quarries, Oswestry, 1866! W. Whitwell.

Anglesey—Beaumaris, "Rogers' Collection," F. H. Sikes.

York S.W.—Conisborough, June 1873, J. Wilcock. Elland, J. Whitwham.

Lancashire S.—Abundant on the walls of a dark recess, heated by discharge of the condensing-water from the engines at the calico print works, Clayton-le-Moors, July 1889! R. Wigglesworth.

Isle of Man—Peel! W. Moss.

SCOTLAND.

Perth Mid—Perth (F. Buchanan White, Scot. Nat., 1873, p. 162).

Ebudes Mid—Isle of Tiree, Sept. 1886! Rev. J. E. Somerville.

Hebrides—Very numerous in churchyard at Eye near Stornoway, Isle of Lewis, Sept. 1886! Alex. Somerville.

IRELAND.

Antrim—Ballycastle, Lionel E. Adams. Plantation Port, Kenbane, 1904, J. W. Jackson.

Leitrim—Glencar near Sligo, July 1904 ! R. Welch.

Cork S.—Cork, Lionel E. Adams. Sherkin Island.

Kerry—Fairly abundant, Mucksna Wood and Tore Wood (R. Standen, Irish Nat., Sept. 1898, p. 219).

CONTINENTAL DISTRIBUTION.

Belgium—Sub-var. *elevata*, not uncommon about Brussels (Van den Broeck, l.c.). Tournay and Lessines in Hainault (T. Lecomte, op. cit., 1870, pp. 56 and 59).

Denmark—Sub-var. *silvatica* is recorded by Westerlund from the Island of Møen, from woods at Fredriksdal in Zealand, and at Veile in Jutland.

Sweden—Sub-var. *silvatica* recorded by Westerlund from Carlskrona and Calmar.

Norway—V. *compacta* recorded from Modum near Christiania by Miss Esmark.

Var. *complanata* Jeffreys, Brit. Conch., 1862, i., p. 159.

Zonites cellarius var. *complanata* Jeffreys, op. cit.

Zonites cellarius var. *plana* Esmark, Journ. of Conch., v., p. 102, Oct. 1886.

SHELL with upper side quite flat.

The sub-var. *canariæ* of Mousson is described as having a depressed spire and wider body-whorl.

ENGLAND AND WALES.

Devon S.—Hedgeside, Welparke, Lustleigh, Oct. 1886, Miss L. J. Gould.

Dorset—Swanage, Oct. 1890 ! C. Ashford. Portland, Feb. 1890 ! E. R. Sykes.

Cambridge—Grantechester ! Hugh Watson.

Northampton—Kettering, C. E. Wright.

Hereford—Not common in the county (Boycott and Bowell, Herefordshire List, 1899, p. 26).

Glamorgan—Cardiff, 1874 ! James Brodie.

Pembroke—Occasionally with type, South Cliff, etc., Tenby (A. G. Stubbs, Journ. of Conch., 1900, p. 323).

Denbigh—Beach of Llandudno Bay, July 1877 ! W. Denison Roebuck.

Lincoln S.—Ancaster, April 1886 ! W. Denison Roebuck.

Leicester and Rutland—Ruins, Kirby-Muxloe, July 1887 ! H. E. Quilter.

Notts.—In damp cellar, Goldsmith st., Nottingham, Mel. 1884 ! C. T. Musson.

Derby—Winster, Aug. 1885 ! Rev. H. Milnes. Stream bank, Darley, July 1892 ! H. E. Craven.

Lancashire S.—Farington, Feb. 1889 ! W. H. Heathcote.

Lancashire Mid—Preston, Feb. 1889 ! W. H. Heathcote. Torresholme and Bolton-le-Sands, Aug. 1905 (H. Beeston, J. of Conch., June 1906, p. 348).

York Mid W.—Ingleton, June 1898 ! W. Moss.

York N.W.—Bowes Castle Keep, July 1884 ! W. Denison Roebuck.

Haddington—North Berwick, Dec. 1888 ! Rev. Dr. J. McMurtrie. SCOTLAND.

Perth Mid—Perth (F. Buchanan White, Scot. Nat., 1873, p. 162).

IRELAND.

Derry—Common at Coleraine, Nov. 1883 ! Lionel E. Adams. Type and var. *complanata*, Limavady Junction, July 1897, J. N. Milne.

Down—Near Warrenpoint, June 1889 ! H. Walmsley.

Tyrone—Baronscourt, Sept. 1904 ! R. Bell.

Donegal—Rosguill, 1893-1905 ! R. Welch.

Dublin—Donnybrook, Aug. 1888 ! G. Barrett-Hamilton.

Westmeath—Knockross, Derravaragh Lake, July 1886 ! W. F. de V. Kane.

Roscommon—Mote Park, Sept. 1904 ! Lord Crofton.

Tipperary S.—Garden, Clonmel, Oct. 1904 ! Mrs. Malcomson.

CONTINENTAL DISTRIBUTION.

Spain—San Roque, Gibraltar ! R. D. Darbishire.

Norway—Sub-var. *plana*, Manger near Bergen (B. Esmark, op. cit.).

Canary Isles—Sub-var. *canaria*, El Monte, Grand Canary.

Var. *præcox* Westerlund, Faun. Palæarct., 1886, p. 54.

Hyalinia (Polita) cellaria var. *præcox* Westerlund, l.c.

Euhyalina cellaria var. *orientalis* Clessin, Moll. Oesterr.-Ung., 1887, p. 69.

SHELL narrowly umbilicated, strong shelled, but glossy, mouth depressly oval, and the margins connected by a callus. Diam., 9 mill. ; alt. 4 mill.

The *H. cellaria* var. *alliaria* of Hazay is probably also a synonym of this variety.

Recorded by Dr. Westerlund from France, Brissago in Switzerland, Nassau in Germany, and Crimea in Russia. The var. *orientalis* is recorded by Clessin from the Tatra Mountains, Hungary.

Var. subaperta Böttger, Jahrb. Deutsch. Mal. Ges., 1879, p. 394.*Hyalinia (Polita) cellaria* var. *subaperta* Böttger, l.c.*Hyalinia (Polita) cellaria* var. *sicula* Westl. Faun. Paläarct. 1886, p. 54.

SHELL widely umbilicated, with smaller and less obliquely oval mouth.

The var. *sicula* Rossm. would appear to belong to this group, being described as widely umbilicated, but attaining a diameter of 13-15 mill. and an altitude of about 6 mill.

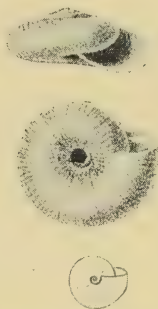
Russia—Keptschag in Transcaucasia (Böttger, l.c.).

Sicily—Sub-var. *sicula*, Sicily (Tryon, Man. of Conch., 1886, p. 156).**Var. sieversi** Böttger, Jahrb. Deutsch. Mal. Ges., 1879, p. 394, pl. 10, f. 8.*Hyalinia (Polita) cellaria* var. *sieversi* Böttger, l.c.

SHELL smaller, almost unicolorous, flatter beneath, umbilicus narrow. Diam., 7 mill.

The var. *minor* of Locard (Ann. Soc. Agr. Lyons, 1879) described as less than 9 mill. diam., will perhaps be appropriately placed with the var. *sieversi*.

Germany—Sub-fossil shells have been found 8½ mill. in diam. at Schalkau in Thuringia (Böttger, l.c.).

France—Sub-var. *minor*, Lyons, department of the Rhone (Locard, l.c.).Russia—The var. *sieversi* seems to be a stunted form with the normal number of whorls. It is more widely distributed than the typical form in Transcaucasia, and has been found plentifully at Tbatani, where the specimens attain 8½-9 mill. in diameter. The shells from Suram are 7½-8 mill.; the Chewsuriens specimens reach almost to the size of the English type shells, being 9-10 mill. diam., and 4½-4¾ mill. in altitude. This variety has also been found at Kusary, Schach-Dagh, and Talysch-Gebietes in the government of Baku; Helenendorf in Elizavetpol, and Letschgum in the government of Kutais (Böttger, op. cit., 1880, p. 117).FIG. 70.—*H. cellaria* v. *sieversi* Bött., natural size and magnified (after Böttger).**Var. obscura** Locard, Etudes sur l. Var. Malac., 1880, p. 45.*Hyalinia cellaria* var. *obscura* Loc., Moll. Ain, 1881, p. 23.

SHELL uniformly dark translucent horn colour, without basal opacity.

Notts.—Garden, Tuxford near Newark, Sept. 1896! W. A. Gain.

Cheshire—Marple, 1902, J. W. Jackson.

France—Mountains of Bugéy, department of Ain (Locard, Moll. Ain, 1881, p. 23).

Russia—Böttger records specimens of *H. cellaria* without basal whiteness from Kasbek in the government of Tiflis, Transcaucasia.**Var. hypozona** Pascal, Moll. Haute Loire et Paris, 1873, p. 28.* *Zonites cellarius* var. *hypozona* Pascal, l.c.

SHELL with an indistinct brownish band beneath.

Dr. Jeffreys records a specimen of *H. cellaria* in his collection having a rufous band on the upper side between the suture and periphery.

France—Wood of Orsay near Paris, rare (Pascal, l.c.).

Var. maculosa Pascal, Moll. Haute-Loire et Paris, 1873, p. 28.*Zonites cellaria* var. *maculosa* Pascal, l.c.

SHELL with some irregularly scattered opaque-white markings.

The sub-var. *maculata* of Locard is horn-coloured with clear yellow fleckings.

ENGLAND.

Northampton—Northampton, Oct. 1883! Lionel E. Adams.

CONTINENTAL DISTRIBUTION.

Seine—Mendon, the woods at Chaville, Raincy, Orsay, Pileux, Bièvre, and the banks of Lake d'Ursine (Pascal, l.c.).

Haute Loire—Damp ditches, woods, and fields about Puy (Pascal, l.c.).

Rhône—Sub-var. *maculata*, Mont d'Or (Locard, Moll. Lyon, 1877, p. 15).

Var. margaritacea Schmidt, Zeitschr. f. Malak., 1851, p. 183.

Helix margaritacea Schmidt, op. cit.

Zonites cellarius var. *albida* Jeffreys, Brit. Conch., 1862, i., p. 160.

Zonites cellarius var. *viridula* Baudon, Nouv. Catal. Moll. Oise, 1862, p. 17.

Zonites rigiacus Bourguignat, Mal. Quatre-Cantons, 1862, p. 21, pl. 1, f. 1-5.

Zonites cellarius var. *subalbida* Locard, Etudes sur Var. Malac., 1880, i., p. 45.

Hyalinia cellaria f. *albina* Westerlund, Faun. Paläarct. Reg., 1886, p. 51.

SHELL white and transparent, or may be of a pearly or clear greenish aspect.

This thicker shelled crystalline yellowish-green form is regarded by Clessin as a result of living in a very moist environment.

The var. **margaritacea** s.s. is a diaphanous pearly-white.

The sub-var. **viridula** is of a clear transparent green tint.

The sub-var. **albina** is bluish-white and semi-opaque.

The sub-var. **subalbida** is opaline-white, clearer beneath, with a paler animal than the type-form.

The sub-var. **albida** is white or colourless.

According to Dr. Kobelt and others, the *Zonites rigiacus* Bourg. is really the crystalline form of the *Hyalinia cellaria*, though regarded by its author as a giant species of the group of *H. crystallina*. It coincides most closely with Dr. Jeffreys' var. *albida*, of which it may be regarded as a stunted alpine form.

The truly albine form, in which the animal and shell are equally affected, is what the Mendelians would term Heterozygous, or a state capable of division into simpler character units. Frequently the shell only is albine, and the animal quite normally pigmented, or the reverse may occur, the animal being albine and the shell quite typical. Van den Broeck mentions a specimen found at Angre in Hainault in which the shell was normal, but the animal pure white, except the irides and the mantle-margin, the latter being thickly spotted with bright rufous.

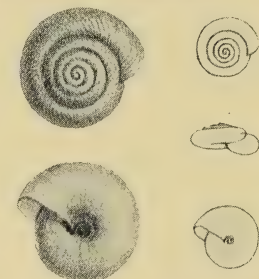


FIG. 71.—*H. rigiaca* Bourg., showing natural size and magnified (after Bourguignat).

ENGLAND AND WALES.

Cornwall W.—Looe, April 1903, Guy Breeden.

Devon S.—Rousdon, April 1903, Guy Breeden.

Hants. S.—Christchurch, Aug. 1883! Charles Ashford.

Sussex E.—Landport near Lewes, C. H. Morris.

Kent E.—Folkestone, Jan. 1883! Mrs. J. Fitzgerald.

Kent W.—Mossy bank near Wrotham, Aug. 1884! T. D. A. Cockerell.

Surrey—Box Hill, Aug. 1883, E. H. Rowe. Caterham Junction, Sept. 1884! T. D. A. Cockerell. Grayswood, as var. *viridulans* (C. Pannell, Surrey List, 1902).

Middlesex—Hamstead Heath, June 1888, J. W. Williams.

Berks.—Sub-var. *viridula*, Maidenhead, July 1884, T. D. A. Cockerell.

Oxford—Deddington, Wytham Hill and near Islip (Collinge, Conch., 1891, p. 19).

Bucks.—Olney, March 1893! Lionel E. Adams.

Northampton—Wood-pit, Stivington, Aug. 1884! W. D. Crick. Yardley Hastings, Aug. 1885! R. Rogers; and a small colony at Whilton, 1896, L. E. Adams.

Gloucester W.—St. Vincent Rocks, Clifton, Oct. 1876! Miss F. M. Hele.

Hereford—Dormington lime quarries (Bowell and Boycott, Herefordshire List, 1899, p. 25).

Worcester—Dudley Castle, Aug. 1899, Guy Breeden.

Stafford—Canal bank, Milford, June 1886, Lionel E. Adams. Caldon Low, May 1898; and Cheadle, J. R. B. Masefield. Ramsor! T. F. Burrows. Stone, E. D. Bostock. Wren's Nest, near Dudley, J. Madison.

Carmarthen—Laugharne, Oct. 1889! G. W. Mellors.

Pembroke—Not uncommon with the type in various places around Tenby, usually clear white, but sometimes clouded (A. G. Stubbs, J. of C., 1900, p. 323).

Anglesey—Puffin Island, Aug. 1883! John Hopkinson.

Lincoln S.—Common about Ancaster, April 1886! W. D. Roebuck. Grantham, July 1902! C. S. Carter.

Lincoln N.—Beech wood, Well Vale, Alford, Sept. 1889! W. Denison Roebuck.

Notts.—Stanton-on-the-Wolds, Mapperley, and in a cellar, Goldsmith street, Nottingham, April 1878! also at Pleasley Vale and Carlton-on-Trent, March 1884! C. T. Musson. Tuxford and Cresswell Crag, April 1885! W. A. Gain.

Cheshire—Disley, 1896, Kenneth H. Jones.

Derby—Belper, March 1880 ! C. T. Musson. Miller's Dale, 1882 ! Rev. H. Milnes. Markland Grip, in which locality the animal was also albino, April 1885 ! W. A. Gain. Cromford ! T. Rogers. Clifton nr. Ashbourne, Aug. 1889 ! L. E. Adams.

Lancashire S.—Farington, Feb. 1889 ! W. H. Heathcote. Foot of wall, Evelyn street, Oldham, F. Taylor.

York S.E.—Albino shells, with animals also uniformly white, even to the tentacles, in the long plantation near Meaux, Nov. 1881, J. D. Butterell.

York N.E.—Raincliff Wood, Scarborough, Aug. 1894, Tom Petch.

York S.W.—Elland, J. Whitwham. Penistone, May 1890 ! Lionel E. Adams. Bottoms, Heckmondwike, May 1901 ! T. Castle. Wakefield, not common, 1882, J. Wilcock. Burghwallis Woods, May 1886 ! W. Denison Roebuck. Heaton and Thackley (Soppitt and Carter, Naturalist, 1888, p. 98).

York Mid W.—Common, Spofforth Castle, Oct. 1886 ! W. D. Roebuck. Saltaire, 1887 ! J. A. Hargreaves. Seven Arches, Bingley, 1887 ! J. W. Carter. Malham Cove, E. Collier. Cottingley, 1890, F. Rhodes. Ingleton, 1903, J. W. Jackson.

York N.W.—Sub-var. *viridula*, Coverdale, Dec. 1887, R. C. Chaytor.

Durham—Durham, 1884, Baker Hudson.

Westmorland and Lake Lancashire—Near Devil's Bridge, Kirkby Lonsdale, J. Davy Dean.

Cumberland—Wetheral, Stanwix, and St. Bees (Miss Donald, Cumberland lists, 1882 and 1885). Bassenthwaite, 1893, W. J. Farrer.

Isle of Man—Port Erin, 1880 ! Lionel E. Adams.

Selkirk—Thornielee, Aug. 1886 ! W. Denison Roebuck.

SCOTLAND.

Edinburgh—Fairmilehead, March 1890 ! W. Evans.

Stirling—Near Bardowie ! A. McLellan.

Main Argyle—Ardhban Craigs, Oban ! W. H. Heathcote.

Dumbarton—Canal side, Maryhill ! Alex. Shaw.

Clyde Isles—Port Bannatyne, Isle of Bute, Sept. 1887 ! Alex. Shaw.

Cantire—Machrehanish Bay, Aug. 1888 ! Alex. Shaw.

Orkneys—Stromness, Sept. 1902 ! J. Waterston.

Louth—Omeath, P. H. Grierson.

IRELAND.

Wexford—Kilmanock, New Ross, April 1888 ! G. Barrett-Hamilton.

Kilkenny—Piltown, Sept. 1904 ! Earl of Bessborough. Gowran, P. H. Grierson.

Mayo W.—Westport, Aug. 1889 ! G. W. Mellors.

Tipperary S.—Rock of Cashel, R. Welch. Clonmel, June 1886 ! Rev. A. H. Delap.

Waterford—Near Clonmel, June 1886 ! Rev. A. H. Delap.

CONTINENTAL DISTRIBUTION.

Germany—Var. *margaritacea*, Aschersleben, in Saxony (Schmidt, l.c.).

France—Sub-var. *viridula*, Forest of Compiègne, Oise (Baudon, l.c.). Sub-var. *subalbida*, rather rare, but segregate, on the Mountains of Bugey, Ain (Locard, l.c.); also in the wood of Jouhe in the Jura (Wattebled, Journ. de Conch., 1889, p. 312); and the var. *albina* of Moquin-Tandon in the Pyrenees.

Switzerland—*Z. rigiacus* in rocks on the Rigi above Weggis; Canton Schwytz, and more abundantly under stones on Mounts Turbia and Valeria above Sion in the Valais (Bourguignat, l.c.). The var. *albina* was found by Mr. Hugh Watson in 1906, at Bex, Canton Vaud, and at Trient in the Valais.

Monst. sinistrorsum Taylor.

SHELL sinistrally coiled.

United States—West Conshohocken, Pennsylvania, R. Walton (C. W. Johnson, Nautilus, Dec. 1893, p. 90).

Geographical Distribution.—This is a widely-distributed species, and is found throughout Europe, extending into Asia Minor, Persia, Northern Africa, and the Atlantic Isles.

H. cellaria has also by commerce become transported to distant and weaker countries, and, being dominant in its class, has established a firm foothold in many parts of the Australasian, Nearctic, and other regions.

In the British Isles it is a widely dispersed and common shell, and is met with not only in country districts, but in the open spaces, as well as in cellars, drains, etc., even in the centre of our busy manufacturing towns.

It has been verified as existing in every county and vice-county of the British Isles excepting Westernness in Scotland, and East Mayo in Ireland.

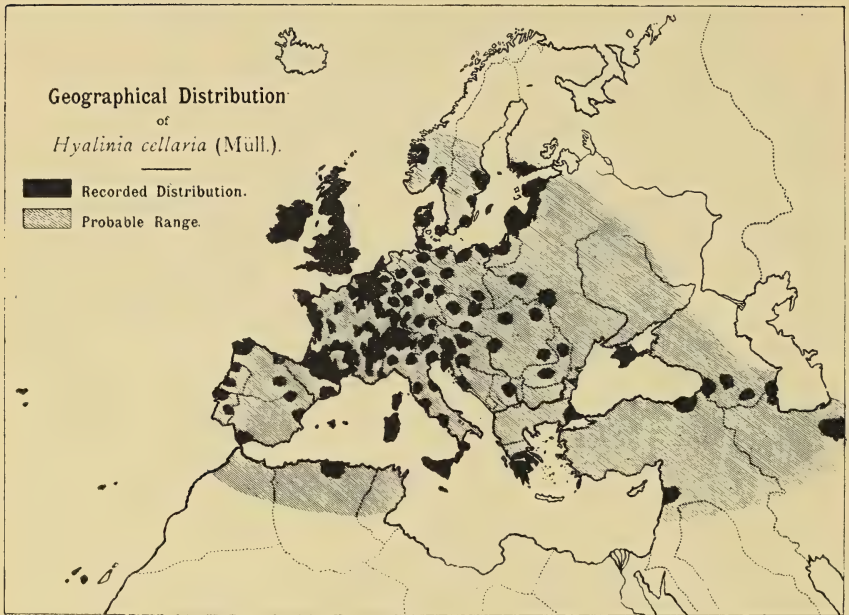


FIG. 72.

GERMANY.

H. cellaria has been recorded from Alsace, Baden, Bavaria, Brandenburg, Brunswick, Cassel, East Prussia, Hanover, Hesse, Holstein, Lippe-Detmold, Lusatia, Mecklenburg, Nassau, Pomerania, Rhenish Prussia, Reuss, Saxony, Silesia, Thuringia, Vogtland, Westphalia, West Prussia, and Wurtemberg.

NETHERLANDS.

Belgium—Recorded for the provinces of Brabant, East Flanders, Hainault, Liège, Limburg, Luxembourg, Namur, and West Flanders.

Holland—Reported by Schepmann for the provinces of North Holland and Utrecht, and also from Rhoon in South Holland. Van den Broeck also records its occurrence at Camsvliet and between Selzaete and Sluys-Kill in Zeeland, and Ubaghs for Maastricht in Limburg.

FRANCE.

Hyalinia cellaria has been recorded for the following districts or departments: Ain, Aisne, Allier, Alpes Maritimes, Aquitaine, Ardennes, Ariège, Aude, Aveyron, Basses-Pyrénées, Champagne Méridionale, Charente Inférieure, Côtes-du-Nord, Côte d'Or, Drôme, Finistère, Gers, Haute Garonne, Haute Loire, Hautes Pyrénées, Haute Savoie, Hérault, Isère, Jura, Landes, Loire Inférieure, Lot, Lot-et-Garonne, Lozère, Manche, Meuse, Morbihan, Moselle, Nièvre, Nord, Oise, Puy-de-Dôme, Pyrénées-Orientales, Rhône, Sarthe, Savoy, Seine, Seine-et-Marne, Somme, Vaucluse, Vendée, Vienne, Vosges, and the Island of Corsica.

SWITZERLAND.

Recorded for the cantons of Aargau, Basel, Berne, Grisons, St. Gall, Solothurn, Schwytz, Uri, Unterwalden, Valais, Vaud, and Zurich.

ITALY.

H. cellaria has been found in Piedmont, Lombardy, Venetia, Tuscany, the Marches, Rome, Campania, Calabria, and the Islands of Sicily, Sardinia, Malta, and Pelagosa.

AUSTRO-HUNGARY.

Recorded for Austria, Bohemia, Carinthia, Carniola, Croatia, Dalmatia, Galicia, Goritz, Hungary, Istria, Moravia, Styria, Transylvania, and Tyrol.

SPAIN AND PORTUGAL.

Spain—Recorded from Andalusia, Catalonia, Galicia, Old Castile, Ternel, Valencia, and the Balearic Isles.

Portugal—Recorded by Hidalgo from the provinces of Estremadura, Alentejo, Beira, and Douro.

BALKAN PENINSULA.

Turkey—Constantinople (Férussac, Hist. Moll., 1822, p. 45).

Roumania—Recorded by Herr Clessin for Rahova in Roumania, and Brostheni in Moldavia.

Servia—Berg Kablar (Möellendorf, Jahrb. Deutsch. Mal. Ges., 1873, p. 131).

Greece—Island of Scio (Hesse, Jahrb. Deutsch. Mal. Ges., 1883, p. 74).

SCANDINAVIA.

Norway—Not very common; Christiania, Skien, Arendal, Lillesand, Brevik, Porsgrund and Langesund in Christiansand, and at Manger near Bergen.

Sweden—According to Westerlund it is found here and there in the province of Skane, and about Stockholm and Upsala, as well as in the Island of Gothland, while Malm records it from Bokedalen near Gothenburg. The var. *compacta* has been stated to have been found at Carlskrona and Calmar.

Denmark—The original specimens from which Müller described the species were obtained from wine-cellars in Copenhagen; and Westerlund says it is found in many places in Jutland and on the islands.

RUSSIA.

Hyalinia cellaria has been recorded from the provinces of Livonia, Esthland, Volhynia, Kovno, Courland, Poland, Lithuania, the Crimea, the south of Finland, and Transcaucasia. The var. *sieversi* has been recorded from the governments of Kutais, Baku and Elizavetpol, and is more widely dispersed than the type throughout Transcaucasia.

ATLANTIC ISLES.

Madeira—Very common on cultivated land and elsewhere (Rev. Dr. Boog Watson, Journ. de Conch., 1876, p. 222). Funchal, 1890-91 (Dr. W. H. Rush, Nautilus, 1891, p. 81).

Azores—Horta, Fayal Island, 1890-91 (Dr. W. H. Rush, l.c.). St. Miguel (Sandberger, p. 895).

Canary Islands—Recorded for Gomera by Mabille; and for Teneriffe, Grand Canary, Palma, and Hierro by G. K. Gude (Proc. Mal. Soc., 1896, p. 17). The var. *canarie* has been found at El Monte, Grand Canary.

St. Helena—Occurs in hundreds in the space of a few square feet near a waterfall (J. S. Gibbons, Q.J.C., Aug. 1878, p. 367).

NORTH AFRICA.

Algeria—Recorded for Philippeville by A. Morelet; from a valley near Bougie by Prof. Forbes; and by Bourguignat on the authority of Debeaux as rare in several localities in Kabylia.

ASIA.

Anatolia—Recorded for the Island of Rhodes by Dr. Kobelt.

Armenia—Recorded by Mousson for Trebizond and Chrysis-Kaleh.

Palestine—In the north only (H. B. Tristram, Proc. Zool. Soc., 1865, p. 532).

Persia—Recorded as *H. cellaria* var. *concinna* Westl., from Siaret, Chorassan (Gude, Journ. of Mal., Sept. 1902).

ORIENTAL REGION.

Philippine Islands—Enumerated as found at Manila (Science, 1884, p. 538).

NEARCTIC REGION.

This species has been introduced into North America by commerce, and has now not only become well established in many cities along the Atlantic and Pacific sea-board, but is spreading rapidly by natural dispersal or by transportation with plants, and has now penetrated far into the interior of the continent.

Maine—Occurs rarely in cellars and gardens, Portland (Morse, Pulm. Maine, 1864, p. 12).

Massachusetts—Common in damp cellars, Boston, and observed in 1862 at Salem, Lynn, and Marblehead (Binney, Land and Freshw. Shells of N. America, 1869, p. 31); Amherst, Bryant Walker, 1885; Swampscott, J. Ritchie, jr., 1885; New Bedford (J. H. Thomson, Journ. of Conch., Oct. 1885, p. 369).

Rhode Island—Noticed at Providence in 1862 (Binney, l.c.); greenhouses in Providence, J. Ritchie, jr., 1885; Newport, J. F. James, 1885; Pawtucket, H. Prime, 1885.

New Hampshire—Observed at Portsmouth in 1862 (Binney, op. cit.).

New York—Found in 1864 at Astoria, Long Island (Binney, op. cit.); Grand View, Rockland co., H. Prime, 1885; Buffalo, Erie co., Rev. W. M. Beauchamp, 1885. Very common, Cazenovia, 1905, G. H. Clapp.

Pennsylvania—Horticultural Hall, Philadelphia (Dr. J. Leidy, 1869); Westchester, W. D. Hartmann, 1885; greenhouses, Alleghany city, R. E. C. Stearns; uncommon, Wissahickon; Conshohocken (R. Walton), and found also in cellars (M. Schick, Nautilus, 1895, p. 135). Say records it as found by Mr. G. Ord in his garden in Philadelphia.

Connecticut—Enumerated by Linsley in his list of Connecticut Shells.

Illinois—Chicago, Bryant Walker, 1885.

Michigan—First found a number of years ago in a greenhouse in Detroit; later a specimen was found in material collected at Alma, Gratiot co., by Prof. C. A. Davis. Another was found amongst a lot of *Vitrea* collected by Prof. F. E. Wood at Bay City; also reported from Detroit and Muskegon (Bryant Walker, Michigan Lists, 1899 and 1906).

Missouri—St. Louis, G. K. Gude.

South Carolina—Introduced at Charleston nearly a century ago, and described by Say in 1817 as a new species under the name of *Helix glaphyrea* (Science, no. 97, 1884).

Dist. of Columbia—Washington, G. H. Clapp, 1902.

Oregon—Portland, very common on the side-walks after rain in the heart of the city (H. E. Dore, 1885).

California—Abundant in San Francisco, delights in crawling over the wooden door-steps (W. M. Wood, Nautilus, July 1894, p. 34); lawns and flower-beds at Oakland, H. Hemphill, 1900.

Nova Scotia—Noticed in 1862 at Halifax (Binney, op. cit.).

Quebec—In drift on Isle d'Orleans, and a few up the St. Charles River (A. W. Hanham, Nautilus, Jan. 1897).

Ontario—Increasing rapidly and extending far inland. Dr. Brodie has found it at Toronto (Litchford, Ottawa List, 1886, p. 20).

Island of Bermuda—(Davis, f. G. K. Gude, 1905).

ETHIOPIAN REGION.

Cape Colony—Recorded from Cape Town by Melvill and Ponsonby, and from Rondebosch by Benson. Cape Town, 1905! R. M. Lightfoot.

NEOTROPICAL REGION.

Chili—Recorded from Santiago by Prof. Dautzenberg.

AUSTRALASIAN REGION.

Victoria—*Hyalinia sydneyensis* recorded as found at Melbourne by Kershaw (C. T. Musson, Proc. Linn. Soc. N.S.W., 1890, p. 893). Port Melbourne, Oct. 1896! J. H. Gatliff.

Queensland—*H. sydneyensis* is recorded for Cape York by J. McGillivray (Cox, Catal. Austr. Shells, 1864, p. 6).

New South Wales—*H. sydneyensis* is abundant in gardens and yards about Sydney (Cox, Monog. Austr. Land Shells, 1868, p. 9). Specimens from Port Jackson in British Museum, T. D. A. Cockerell, July 1885.

Tasmania—*H. sydneyensis* abundant in cellars, yards, and other similar places in Launceston and Hobart (Petterd, Monog. Tasmanian Land Shells, 1879, p. 43). Common in the vicinity of Mount Wellington, Huon river (R. M. Johnston, Proc. Roy. Soc. Tasmania, 1879, p. 52).

New Zealand—Wanganui! H. Suter. Common at Auckland! T. F. Cheesman, 1905. *H. sydneyensis* recorded as abundant in cellars and similar places in Auckland, and also under stones, especially about the various volcanic mountains. It has also been found at the Bay of Islands, Napier, by Capt. Hutton.

Society Islands—Recorded as found here (Science, 1884, p. 538).

Distribution of *Hyalinia cellaria* (Müller).

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles		SOUTH WALES
PENINSULA	41	Glamorgan
1 Cornwall W.	42	Brecon
2 Cornwall E.	43	Radnor
3 Devon S.	44	Carmarthen
4 Devon N.	45	Pembroke
5 Somerset S.	46	Cardigan
6 Somerset N.		NORTH WALES
CHANNEL	47	Montgomery
7 Wilts N.	48	Merioneth
8 Wilts S.	49	Carnarvon
9 Dorset	50	Denbigh
10 Isle of Wight	51	Flint
11 Hants S.	52	Anglesey
12 Hants N.		TRENT
13 Sussex W.	53	Lincoln S.
14 Sussex E.	54	Lincoln N.
THAMES	55	Leic. & Rutld.
15 Kent E.	56	Notts.
16 Kent W.	57	Derby
17 Surrey		MERSEY
18 Essex S.	58	Cheshire
19 Essex N.	59	Lancashire S.
20 Herts.	60	Lancashire Mid
21 Middlesex		HUMBER
22 Berks.	61	S.E. York
23 Oxford	62	N.E. York
24 Bucks.	63	S.W. York
ANGLIA	64	Mid W. York
25 Suffolk E.	65	N.W. York
26 Suffolk W.		TYNE
27 Norfolk E.	66	Durham
28 Norfolk W.	67	Northumb. S.
29 Cambridge	68	Cheviotland
30 Bedford		LAKES
31 Hants.	69	Westmorland
32 Northampton		and L. Lanes.
SEVERN	70	Cumberland
33 Gloucester E.	71	Isle of Man
34 Gloucester W.		
35 Monmouth		
36 Hereford		
37 Worcester		
38 Warwick		
39 Stafford		
40 Salop		

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easternness
76 Renfrew	W. HIGHLANDS
77 Lanark	97 Westernness
E. LOWLANDS	98 Main Argyll
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Pth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

Probable Range.



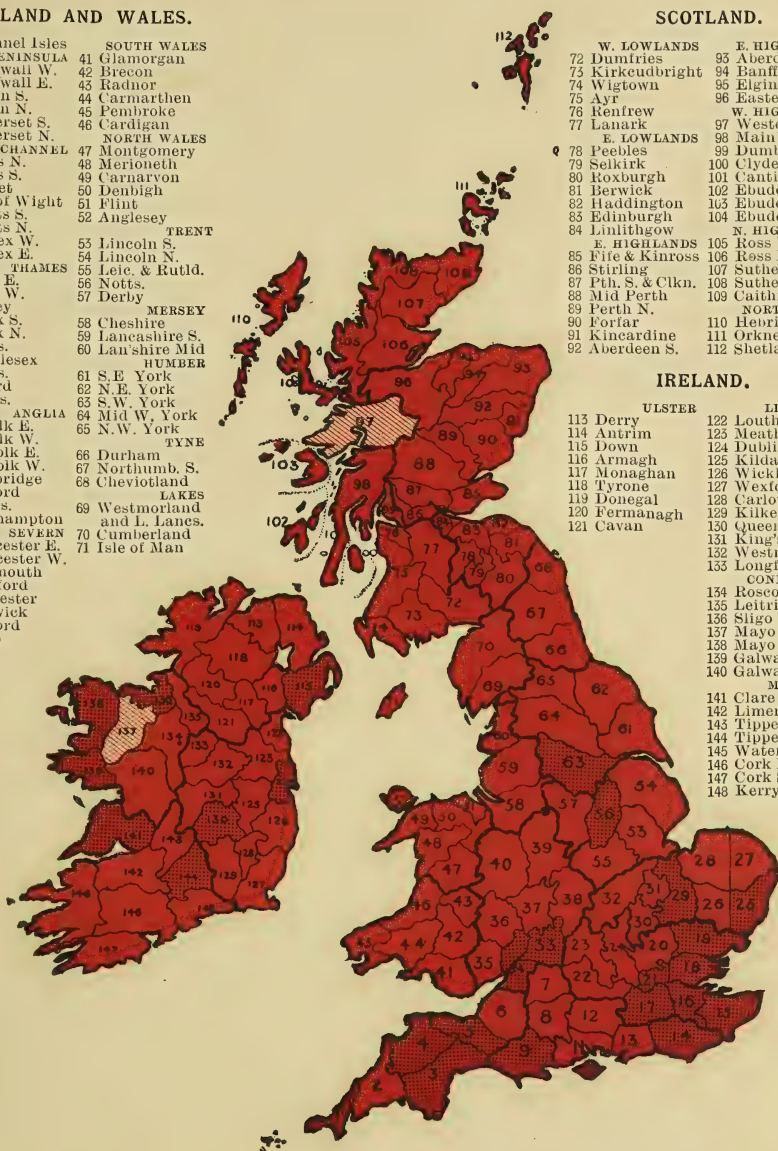
Recorded Distribution.



Distribution verified by the Author.



Geological Distribution.



Hyalinia helvetica (Blum).

- 1840 *Zonites alliarius*, var. 2, Gray's Turton's Man., p. 169.
 1870 — *glaber* Jeffreys, Ann. and Mag. Nat. Hist., p. 385.
 1849 *Helix glabra* Dupuy, Hist. Moll. France, p. 228, pl. x., f. 6.
 1881 *Hyalina helvetica* Blum, Nachr. Deutsch. Mal. Ges., p. 141.
 1887 *Euhyalina subglabra* Clessin, Moll. Oesterr.-Ung., p. 72.
 1891 *Vitrea (Polita) glabra* Smith, Journ. of Conch., vi., p. 339.
 1903 — *rogersi* B. B. Woodward, J. of Conch., x., p. 309, pl. vii., ff. 2, 5, 11-13.
 1896 *Hyalinia helvetica* Adams, Manual, second edition, p. 47, pl. 2, f. 6.



HISTORY.—*Hyalinia helvetica* (*Helvetia*, Switzerland), is a species which was long confused with *H. alliaria*, *H. glabra*, and other forms, and its specific status has only comparatively recently been satisfactorily established.

Some time before 1870, the late Mr. Thomas Rogers of Manchester, a very acute and diligent botanist, as well as one of our most thoughtful and discerning conchologists, to whom the species is here dedicated, found examples at Marple in Cheshire, and was so impressed with their peculiarities that in 1870 he forwarded specimens to Dr. Gwyn Jeffreys, at that time our foremost authority, who decided that they were referable to *Zonites glaber* of Studer, and this name was forthwith adopted for the species.

Although thus brought forward as new to Britain, the form had already been noted by Mr. Alder and others, but was

regarded by them as a large variety of *Hyalinia alliaria*, under which name specimens were sent out to continental conchologists by Reeve, Jeffreys, and others, and therefore gave rise abroad to much misapprehension and confusion.

Later investigations appeared to show that the modern reference to *Zonites glaber* was not really justified, and that such differences existed between the two forms as warranted specific recognition.

Meanwhile Dr. Blum of Frankfort, who had collected similar specimens in Switzerland, was so convinced of their differential characters, that he described them as a new species under the name of *Hyalina helvetica*, and has recognized British shells as being perfectly identical with his species.

Herr Clessin, while accepting Blum's species as valid, erroneously regarded it as identical with Bourguignat's *Zonites subglaber*, which name as being the oldest he adopted.

In 1903, Mr. B. B. Woodward, dissatisfied with all the previous names and allocations, again described the British specimens as new, under the name of *Vitrea rogersi*, partly led to his belief in its difference from *Hyalinia helvetica* by an accidental abnormality of the admedian teeth of the single continental specimen of *H. helvetica* he had the opportunity of examining.

Thomas Rogers

This proposal to separate our British specimens of *Hyalinia helvetica* as an independent species is, however, to be earnestly deprecated as adding another ill-defined and unsatisfactory species to an already difficult group; a form, too, which shows no real external differences, and is based almost solely on slight and insufficient variations in an organ so unstable as the radula has been shown to be in the *Hyalinia*, and which render this organ an eminently unsuitable one on which to base a new species of *Euhyalinia*, as the species already recognized owing to their closely intimate relationship and similarity to each other are so difficult to identify correctly as to have often led to many serious errors of discrimination and record.

The precise characters upon which the proposed separation is chiefly based are described as a slightly larger radula with somewhat less numerous longitudinal and transverse rows of teeth thereon; but more especially the different form of the admedian teeth. It is, however, unfortunate, that the distinctions shown are not conclusive or satisfactory, as the teeth figured by Mr. Woodward to illustrate the difference between his *H. rogersi* and *H. helvetica* are not truly representative, both being more or less abnormal examples of the forms to which they are referred, and if accurately drawn, aptly illustrate the variability of the teeth and their unsuitability taken alone to furnish reliable specific characters.

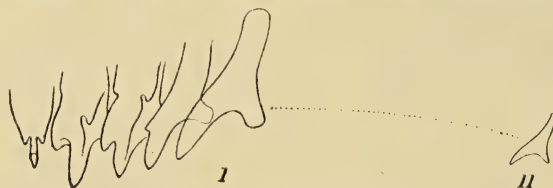


FIG. 74.—Representative teeth from the odontophore of *Vitrea rogersi* B. B. Woodward, $\times 180$ (after Woodward).

The formula of the figured specimen is given as

$$11 + 1 + 2 + 1 + 2 + 1 + 11 \times 40 = 1,160.$$

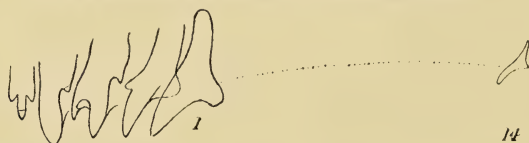


FIG. 75.—Representative teeth from the odontophore of a topotype of *Vitrea helvetica* (Blum) from Solothurn $\times 180$ (after Woodward).

The formula of the figured specimen is given as

$$14 + 1 + 2 + 1 + 2 + 1 + 14 \times 45 = 1,575.$$

The radulae of many British specimens of *H. helvetica* from widely distant districts have been carefully examined by Messrs. Moss and Boycott, who have verified the great variation to which it is subject and as a result of their researches regard the species as in this respect not closely homogeneous but in a transitional stage; the variation in the number of the transverse rows being found to be from thirty-one to forty-five, and the longitudinal rows ranging from twenty-five to thirty-two, while the median row though most usually presenting a long and well-developed mesocone, very frequently has the median cusp truncate and scarcely or not at all projecting beyond the adjoining ectocones, resembling in this respect the true *Hyalinia glabra*, in which this peculiarity is a constant and invariable feature.

The continental specimen of *H. helvetica* examined by Mr. Woodward shows forty-five transverse and thirty-five longitudinal rows of teeth on the radula, agreeing in the latter respect with Herr Schepmann's observations, and in this point a tendency is undoubtedly shown by the species gener-



FIG. 76.

FIG. 76.—Representative denticles from half a transverse row of the odontophore of a toptype of *Hyalinia helvetica* (Blum), from Solothurn, $\times 200$ (after Schepmann).

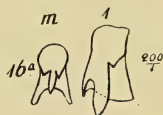


FIG. 77.

FIG. 77.—Mid and admedian teeth of *Hyalinia helvetica* (Blum), from Folkestone, collected by Mrs. Fitzgerald, $\times 200$ (after Schepmann).

ally towards an increase in the number of marginals, and though Signor Pollonera has satisfactorily established that this feature is due to the increasing age of the animal, yet the examples inhabiting Central Europe would appear to have advanced a step further and reached a point of greater equilibrium in this respect than those of our own country, thus again enforcing the truth of the principles of evolution and geographical distribution propounded in the present work.¹

Diagnosis.—The SHELL of *H. helvetica* may be separated from that of its close ally, *H. alliaria*, by its larger size, its more convex and swollen outline above, and its greater flatness beneath; the umbilicus also is comparatively and actually narrower, and the surrounding opaque whitish area more pronounced.

From *H. cellaria* it may be distinguished by its smaller size and greater proportionate height, its rounder mouth, its less perceptible basal opacity, and by the umbilicus not disclosing the penultimate whorl so fully as in *H. cellaria*.

The ANIMAL is distinguished from that of *H. alliaria* by its paler colouring, the much more distinct zebra-like markings of the body, and the deep-black edging to the mantle, which shows as a broad and sharply-defined black line near to and parallel with the mouth of the shell whether the animal be in motion or retracted and at rest within. In crawling, the tail extends considerably beyond the shell.

From *H. cellaria* it differs strikingly by the distinct zebra-like transverse striping along the sides of the body, and by the peculiar broad and black mantle margin.

INTERNALLY, the white arterial network overspreading the surface of the liver or digestive gland is a characteristic feature, in which it resembles *Zonitoides excavata* and also *Arion ater*, while the radula often shows a weaker development of the mesocone of the median teeth, resembling in this respect the true *H. glabra*.

Description.—ANIMAL with a bluish-grey BODY, darkest towards the head, but showing whitish-grey by transmitted light; faintly darker zebra-like transverse stripes are distinctly perceptible on the sides of the BODY, arising at the DORSAL GROOVES and terminating at the lateral lines, below which the colouring is paler and the tuberculation less crowded; MANTLE quite dusky, its outer margin sharply defined by the characteristic broad black line; FOOT-SOLE long and narrow, about 15 mill. long and nearly 2 mill. wide when crawling, of a yellowish-grey colour, but in some specimens when the animal is contracted the disc appears quite yellow; TENTACLES about 4 mill. long, somewhat slender and granulated, of a dark-grey or

¹ Monog. i., p. 385 to 403 and pls. iii., iv., and vi.

lead colour, due in part to the dark RETRACTORS, which show as a gradually paling line at each side of the back; lower tentacles pale grey, and about 1 mill. in length.

MUCUS thin and almost colourless.

SHELL somewhat convex above and rather compressed beneath, very smooth, semitransparent and glossy, with faint and shallow transverse striation, most prominent at the suture; of an amber-brown colour above, paling beneath into a whitish area around the UMBILICUS, which is narrow and deep; WHORLS 5-6, convex, increasing regularly, spire slightly elevated; SUTURE distinct; APERTURE crescentic, slightly oblique; PERISTOME thin and sharp.

When the animal is withdrawn into the shell, the upper side appears of a dark yellowish-brown, darker towards the apex, and showing near the mouth of the shell a black margin to the edge of the mantle, $1\frac{1}{2}$ to 2 mill. in width; the under-side is dark brown up to the triangular and dark renal organ, beyond which the body is blackish in parts with the black margin to the mantle, as on the upper side.

Diam., maj. 8 mill.; min. 7 mill. Alt. 4 mill. Average weight of the adult shell about $\frac{2}{3}$ ths of a grain.

The ALIMENTARY CANAL is scarcely distinguishable from that of its allies, and is of the usual tridromous character, with its first anterior flexure held in place by the CEPHALIC AORTA; the SALIVARY GLANDS are attached to the sides of the OESOPHAGUS, the secretion being conveyed to the BUCCAL CHAMBER by a pair of long and slender ducts; the LIVER is composed of dusky yellow follicles separated by dark grey pigment, and the hepatic white arterial plexus is very striking and distinctive.

The REPRODUCTIVE ORGANS display a whitish OVOTESTIS with scattered lobules; the HERMAPHRODITE DUCT is scarcely convoluted, and thickest in the middle, terminating in a thick, blunt, and milk-white VESICULA SEMINALIS; ALBUMEN GLAND somewhat fusiform, closely lobed, whitish, tinged with brown; OVISPERMATODUCT narrow above, more ample below; the OVIDUCT light grey with distinct folds; SPERM-DUCT thin and narrow above, thick and opaque-white below; FREE-OVIDUCT of almost uniform thickness, slightly thickening below; SPERMATHECA narrowly oval, tinged brown, with muscular attachment to the oviduct, its duct about double the length of the vesicle, slender above, much wider below, its junction with the free-oviduct concealed by the ample, whitish, and flocky VAGINAL GLAND; VAS DEFERENS is as usual in *Euhyalina*, filiform until it has passed through the muscular tissue at the base of the PENIS-SHEATH, when there is an abrupt enlargement, which afterwards gradually diminishes until it joins the epiphallus near its apex, the terminal retractor being fixed to the upper region of the oviduct; the EPIPHALLUS is thick and oblong in shape, contracting to join the penis-sheath, which gradually enlarges towards the base, where it again contracts before entering the short ATRIUM.

The MANDIBLE or jaw is nearly a millimetre across, convex from front to rear, crescentic in shape, with a distinct and somewhat acutely-pointed rostrum or beak projecting from the middle of the lower or cutting margin. The mandible generally is of a dark fawn colour, with a thickened and dark black-brown area in the centre, which extends quite to the apex of the beak, leaving a paler crescentic area at each side of the rostrum along the cutting margin.



FIG. 78.—Section through the shell of *H. helvetica* to show the shape and character of the whorls and umbilical cavity, $\times 4$ (from a preparation by Mr. F. Rhodes).

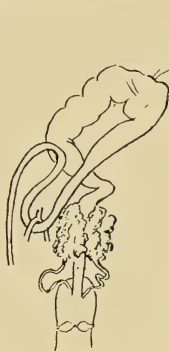


FIG. 79.

FIG. 79.—Alimentary canal of *H. helvetica*, $\times 3$. (Llienog Castle, Anglesey, Mr. T. Rogers).



FIG. 80.

FIG. 80.—Sexual organs of *H. helvetica*, $\times 3$. (Llienog Castle, Anglesey, Mr. T. Rogers).

a.g. albumen gland; ot. ovotestis; ov. oviduct; pr. prostate or sperm duct; sp. spermatheca; r. retractor; v.d. vas deferens; g. vaginal gland; p.s. penis sheath, with epiphallus.

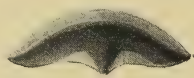


FIG. 81.—Mandible or jaw of *H. helvetica*, $\times 20$. (Anglesey, Mr. T. Rogers).

The LINGUAL RIBBON is usually about three mill. long, and composed of about forty arcuately transverse rows of teeth; the small median teeth are as usual tricuspid, but the central cusp is at times only feebly developed, resembling in this respect the true *H. glabra*, with which this species was so long confused; there are two undoubted lateral teeth at each side, bearing three irregular cusps or cutting points in addition to a transition tooth, in which the endocone is faintly developed, but the ectocone has disappeared; the marginal teeth are all strictly aculeate, and vary in number from nine to fourteen or even more on each side.



FIG. 82.—Transverse row of teeth from the odontophore of *Hyalinia helvetica*, $\times 200$, showing the more usual form of the median tooth. The animal collected by Mr. C. Oldham at Bettws-y-Coed, Wales (after a photo. by Mr. W. Moss).



FIG. 83.—Transverse row of teeth from the odontophore of *H. helvetica*, $\times 200$, showing the truncate mesocone of the median tooth. The animal collected at Llieniog Castle, Anglesey, by Mr. T. Rogers, and the palate prepared by Mr. J. W. Neville (after a photo. by Mr. W. Moss).

The formula of an Anglesey specimen is

$$\frac{10}{1} + \frac{1+2}{2-3} + \frac{1}{3} + \frac{2+1}{3-2} + \frac{10}{1} \times 40 = 1,080.$$

Food and Habits.—*Hyalinia helvetica* inhabits by preference very shady and almost gloomy woods and thickets. In the original locality at Marple, where this species is found plentifully beneath stones, among



FIG. 84.—Wood at Marple, Cheshire, Mr. C. Oldham collecting *Hyalinia helvetica* at the original spot where Mr. Thos. Rogers first found the species. (Photograph by Mr. T. Baddeley).

nettles, garlic, dog's mercury, etc., the hanging woods are so dense that the sun scarcely ever penetrates within their recesses. It is especially

partial to living amid moist, dead leaves and amongst thick, damp moss, being often very plentiful under such conditions, even in larch woods. Under certain circumstances it gives off a more or less pungent odour of garlic, though this faculty is not so pronounced or invariable as in *Hyalinia alliaria*. It is very indifferent to cold and in ordinary seasons scarcely hibernates at all. The heart of a specimen examined about mid-day in June was found to pulsate about the rate of sixty times per minute at a temperature of 62° Fahr. Though probably chiefly vegetarian in habit, it is also very predatory, and in captivity has been known to kill and devour examples of *Helix hispida*, *Patula rotundata*, *Hyalinia fulva*, and *Vitrina pellucida*, confined in the same receptacle.

Reproduction and Development.—No details are known nor have observations been recorded of the congress of this species. The seminal element is, however, known to be transferred by means of a spermatophore and pairing has been observed at Marple as taking place in April, by Mr. W. Moss, and by Mr. Lionel E. Adams at Merstham in Surrey in October, while Mr. Hainsworth found amongst others normally employed, an adult specimen paired with an adolescent *Helix rufescens* at Addingham, Yorkshire, in August 1906.



FIG. 85.—Spermatophore of a Marple specimen of *H. helvetica* $\times 6$ (after a photo. by Mr. W. Moss).

Geological History.—For this species only one locality is as yet known, the Pleistocene deposit within the Ightham fissure near Wrotham, West Kent, where several specimens have been found.

Variation.—The variation in the external morphology of the present species would appear to be not very great, the published records only showing that the albino form and one in which the whitish basal opacity is more sharply delimited have as yet been registered.

The internal organization is, however, much more unstable, the denticles of the odontophore being exceptionally irregular numerically and morphologically, and the reproductive organs being also described by Mr. Moss as varying very greatly in their form and in the relative proportions and development of the different parts.

The large, darkly coloured and more widely-umbilicate shells discovered by Mr. J. W. Jackson in Yorkshire, and here described as var. *umbilicata*, but of which the internal structure is unfortunately as yet quite unknown, have externally their closest affinity with the specimens found in Highgate Woods and at Finchley in Middlesex by Mr. J. E. Cooper, and by Mr. C. Oldham at Bettws-y-Coed in Carnarvonshire.

The specimens from these localities, while resembling the widely-umbilicate forms externally, correspond most closely as regards the radula with the more narrowly perforate typical form named *Vitrea rogersi* by Mr. B. B. Woodward, which he described as possessing an odontophore one-third larger than that of *Hyalinia alliaria*, and as bearing about forty transverse rows of denticles.

The Middlesex and Carnarvon specimens, as compared with the more narrowly perforate typical form from Anglesey and elsewhere, are said to show a slightly larger radula, and somewhat more numerous transverse and longitudinal rows of teeth thereon, features, however, which may be due to the relative age of the individuals examined and to differences possibly arising during the process of preparing the radula.

According to the careful observations of Messrs. Moss and Boycott, the more openly umbilicated Middlesex and Carnarvon specimens examined by

them possessed radulae bearing 37-45 transverse rows of teeth, with an average of about 41; the average size of the radula was 2.3×0.53 mill., the average number of marginal teeth on each side was 11.1, and the space occupied by ten rows was 0.56 mill.

The few specimens examined of the more narrowly perforate typical form from Anglesey and Northampton possessed radulae bearing only 31-38 transverse rows, with an average of 34; the average size of the radula was 1.7×0.45 mill.; the average number of marginal teeth on each side was 10.6, while the space occupied by ten rows of teeth was 0.5 mill.

Specimens from Hochwald, Austria, recorded as *Zonites glaber* var. *striaria* by Prof. Cockerell, are in his opinion certainly the *Zonites glaber* of Jeffreys, resembling the Cheshire rather than the South of England forms.

He described them as of a transparent yellowish-horn colour, very shining and flattish; aperture more semi-lunar than usual; umbilical region hardly whitish. Max. diam., $11\frac{1}{2}$ mill.

Messrs. Moss and Boycott, who received specimens under the same name through Dr. Babor, remark, however, that the animals examined by them showed the dental characteristics of the true *Hyalinia glabra*, and not those of *H. helvetica*.

VARIATIONS IN SHELL.

Var. *umbilicata* var. nov.

SHELL rather larger and more deeply coloured, with a more depressed spire, and consequently a more open umbilicus. Diam., 11 mill.; alt., 5 mill.

This is a very striking shell when characteristic, but is connected with the typical form by intermediate gradations.

ENGLAND.

York Mid W.—Malham Cove, July 1903! J. W. Jackson.

Var. *viridans* Cockerell, Science Gossip, 1885, p. 226.

Zonites glaber var. *viridula* Adams, Journ. of Conch., 1890, p. 265.

SHELL transparent and greenish-white.

ENGLAND AND WALES.

Dorset—Portland, Aug. 1892! Lionel E. Adams.

Kent W.—Four specimens with type on a bank at Bromley (Cockerell, l.c.).

Northampton—Castle Ashby, June 1906, Rev. W. A. Shaw.

Cheshire—Near Warrington, March 1906, J. Whitwham. Disley, 1893, and Marple, 1894, K. H. Jones. A greenish variety at Oakwood (J. W. Jackson, Journ. of Conch., July 1903, p. 336). Sparingly at Romiley, 1903, J. W. Jackson.

York S.W.—Bramley Fall Wood, Nov. 1889 (F. Rhodes, Sci. Goss., Aug. 1890, p. 190). Buck Wood, Thackley, 1890, A. Hartley. Gunthwaite near Penistone, April 1890! Lionel E. Adams.

IRELAND.

Kerry—Kenmare, 1898! R. Welch.

Var. *bicolor* Cockerell, Science Gossip, Jan. 1886, p. 20.

SHELL with whitish basal opacity well marked and sharply defined from the brown colour of the rest of the shell.

The author views this variety as atavie.

ENGLAND.

Kent W.—Bromley (Cockerell, l.c.).

Geographical Distribution.—Owing to the confusion which has reigned in regard to the identification of this species, its range abroad is almost unknown; it has, however, been authentically reported from Switzerland, Germany, France, and Belgium, and probably also exists in many other countries. The *Zonites glaber* var. *striaria*, inhabiting Tran-

sylvania, Austria, Poland, and Galicia, has been referred to this species by Prof. T. D. A. Cockerell, but it is by no means certain that this identification is correct.

In the British Isles, it is found fairly well distributed over England, the south-west of Scotland, and in a few scattered localities in Ireland.

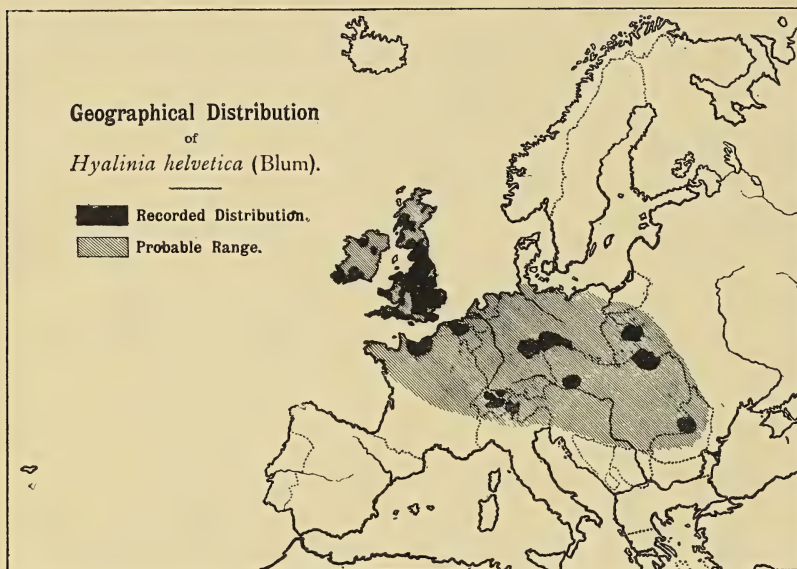


FIG. 86.

ENGLAND AND WALES.

Channel Isles—Rozel Bay, Jersey, F. H. Sikes. Guernsey, 1864, W. Rich.

PENINSULA.

Cornwall W.—Common at Rewggan, Trewan, and along the Trevidock road, St. Columb, May 1885 ! W. Vinson. Newquay, Sept. 1886, and Truro, Dec. 1888 ! J. H. James. Penzance, Aug. 1903 ! F. H. Sikes. About Helston, often in colonies (Wright and Adams, J. of Conch., July 1905, p. 223).

Cornwall E.—Lostwithiel, Dec. 1888 ! J. H. James. Fairly common among wet and decaying rushes in a marsh near the sea, Looe, April 1903 ! Guy Breeden. Stratton, Sept. 1903 ! Miss Roebuck.

Devon S.—Saltram Wood, Plymouth, 1870 ! C. Ashford. Culverhole landslip, Aug. 1892, L. E. Adams. Stoke Woods near Exeter (Marquand, J. of Conch., 1889, p. 138). Sidmouth, Nov. 1903, Rev. W. A. Shaw.

Somerset S.—Minehead, Aug. 1892 ! Lionel E. Adams.

CHANNEL.

Dorset—Portland, Aug. 1892 ! Lionel E. Adams.

Isle of Wight—Ventnor, 1885 ! J. W. Wood.

Hants. S.—Purbrook, Aug. 1905, F. H. Sikes. Hayling, C. E. Wright.

Sussex E.—Eastbourne, Aug. 1905, F. H. Sikes.

THAMES.

Kent E.—Sandwich, Aug. 1906 ! F. H. Sikes. Folkestone, rare, 1883, Mrs. Fitzgerald. Common, Maidstone ! (Elgar and Lamb, Journ. of Conch., Jan. 1893, p. 154).

Kent W.—Bromley ! West Wickham, Paddock Wood, Wrotham, St. Mary Cray and near Chislehurst, 1884, T. D. A. Cockerell. Orpington, June 1885 ! and Seven-oaks, Aug. 1887, S. C. Cockerell. Charing, in woods and hedges, Sept. 1891, L. E. Adams. Wood, Brasted, Sept. 1903 ! F. H. Sikes. Chalk-pit near Shorne, Oct. 1888, G. K. Gude.

Surrey—Box Hill, Aug. 1883, E. H. Rowe. Garden, Warham road, Croydon, May 1885 ! Kenneth McKean. Addington, Redhill, Reigate and Shiere, Aug. 1884 ; Caterham, Warlingham, and Croham Hurst, Sept. 1884 ! T. D. A. Cockerell. Dorking, Sept. 1886 ! C. Oldham. Barnes Common and Headley lane (E. H. Rowe, The Garner, 1886, p. 19). Sutton, Oct. 1902, F. H. Sikes. Godstone, June 1899 ! J. E. Cooper. Polesden ; Barnes ; Tatsfield ; Chaldon ; and Limsfield (C. Pannell, jun., Journ. of Conch., April 1902, p. 170).

Essex N.—Colchester, 1870 ! W. G. Blatch. Felstead, March 1888 ! J. French. Sudbury, E. Ransom.

Herts.—Wain Wood near Hitchin, abundant, Apr. 1873 ! C. Ashford. Plentiful, but confined to a very restricted area in a larch wood at Baldock, Oct. 1875 ! J. W. Wood. Beneath bricks and stones, Berry Wood near Otterspool, May 1875 (H. J. J. Lavis, Trans. Watford Soc., 1876, p. 17). Grounds of Ware Priory (Norman, Ann. and Mag. Nat. Hist., 1890, p. 330). Sandridge, 1883 ! A. F. Griffith. Woods by Swiss Cottage, Cassiobury Park, and Oxhey near Watford, Sep. 1883 ! J. Hopkinson. Armwell (A. G. Stubbs, Journ. of Conch., Jan. 1906, p. 272). Rickmansworth, Feb. 1906, F. H. Sikes.

Middlesex—Near London, 1868 (W. Rich, Science Gossip, July 1870, p. 161). West Drayton, 1884, C. W. Cheadle. Near Finchley, March 1885, A. H. Shepherd. Hanwell, March 1885, and Ealing, June 1885 ! S. C. Cockerell. Highgate Woods, April 1898 ! J. E. Cooper.

Berks.—Reading, Aug. 1885 ! C. G. Barrett. Bradfield near Reading, quite as common as *H. cellaria*, Rev. E. Peake, Dec. 1906.

Oxford—By no means generally distributed. Broughton churchyard near Banbury, June 1887 ! Blenheim Park, July 1904 ! Rev. S. Spencer Pearce. Bicester, 1887 ; rare at Swincomb, and recorded by Rev. S. Spencer Pearce from Wick Copse and Woodeaton, Oxford (W. E. Collinge, Conch., 1891, p. 19).

Bucks.—Abundant at Olney, Aug. 1893 ! L. E. Adams. Colnbrook, June 1906, F. H. Sikes.

ANGLIA.

Suffolk E.—Plentiful, Mendlesham (A. Mayfield, Journ. of Conch., Apl. 1903, p. 296). Common at Felixstowe, Nov. 1904 ! F. H. Sikes.

Suffolk W.—Monkswood, Felsham ! and Sudbury ! Dr. Churchill Babington, 1888. Common about Wetherden, Drinkstone, Haughley, Walsham-le-Willows, Elmswell, Felsham, Bildeston, Whepstead, Heugrave, and Lavenham (A. Mayfield, Journ. of Conch., July 1906, p. 334).

Cambridge—Hauxton Mill ! Hugh Watson.

Bedford—Sharnbrook, 1874 ! J. W. Wood. Barton cutting, April 1888 ! and cemetery near Luton, Sept. 1888 ! J. Saunders.

Hunts.—Paxton Hill near St. Neots, 1905 ! Miss K. B. Watson.

Northampton—The commonest species of the genus in the county. Very abundant in the south of the county, especially around Castle Ashby, Kettering, and Oakley (L. E. Adams, Northants List, 1896). Irchester, June 1884 ! Rev. H. H. Slater. Near Blakesley, 1883 ! A. Loydell. Easton Wood, Yardley Hastings, Oct. 1885 ! R. Rogers. Northampton, Sept. 1893 ! and Brayfield, Jan. 1893, L. E. Adams. Easneye (Loydell and Rowe's List, 1883, p. 21).

SEVERN.

Gloucester W.—Bristol, 1868, W. Rich. Gloucester, May 1883, W. H. Boland.

Hereford—Not very common, but widely distributed amongst dead leaves in woods (Boycott and Howell, Moll. of Herefordshire, 1899, p. 26).

Warwick—Edgehill, Aug. 1893 ! L. E. Adams. Sutton (H. Overton, Journ. of Mal., Sept. 1900, p. 171).

Stafford—Stafford Castle, Oct. 1885 ! and Brewood, 1886 ! Lionel E. Adams. Weaver Hills, T. F. Burrows. Heighley Castle, A. T. Daniel. Longdon, Guy Breeden. Consall, J. R. B. Masefield.

Salop—Craigforda Wood, June 1885 ! B. Hudson. Much Wenlock, Sept. 1885 ! E. Collier. Soudley, Hazler, etc., near Church Stretton (Buddicom's Church Stretton List, 1904, p. 183).

SOUTH WALES.

Carmarthen—Common about Laugharne, Sept. 1883 ! C. Jeffery.

Pembroke—Reported for Hoyle's Mouth, Tenby, in 1887, by C. Jeffery.

NORTH WALES.

Montgomery—Among moss in Hones Llyswen dingle, March 1885 ! also under bark in Gungrog dingle near Welshpool, April 1885 ! J. Bickerton Morgan.

Merioneth—Torrent Walk, Dolgelly, Aug. 1884 ! John Hopkinson. Barmouth, 1857 (J. G. Jeffreys, l.c.). Towyn, May 1890 ! Lionel E. Adams.

Carnarvon—Woods above Llanfairfechan, by the Afonden, Aug. 1883 ! John Hopkinson. Gwydir Gate, Trefriw, Dinas Station, and by stream near Conway, July 1883 ! W. Denison Roebuck. Bettws-y-Coed, May 1898 ! Charles Oldham.

Denbigh—Llanrwst ; common at Eglwys Rhos ; Tal-y-Cafn ; Gloddaeth Woods ; Llangwystenin ; Llandrillo-yn-Rhos ; and foot of Little Orme's Head, July 1883 ! W. Denison Roebuck. Llandulas, Sept. 1885 ! E. Collier. St. Asaph, Aug. 1889 ! Lionel E. Adams. Llangollen, 1902, J. W. Jackson.

Flint—Towerfields, Mold, Sept. 1891 ! T. Shankland.

Anglesey—Near Red Wharf Bay and among moss in damp wood by a stream at Llandisilio, Sept. 1883 ! John Hopkinson. Llanfaes near Beaumaris, Aug. 1886 ! J. G. Milne. Ruins of Lleniog Castle and in a wood near Beaumaris, April 1887 ! and Lliwgy, Aug. 1897 ! Thomas Rogers. Menai Bridge, 1897 ! F. Taylor.

TRENT.

Lincoln S.—Roadsides, Branston Booths near Lincoln, Sept. 1889 ! W. Denison Roebuck. Old stone quarry, Great Ponton, Aug. 1902 ! R. Worsdale.

Lincoln N.—Haugham Wood, Burwell Wood, and Maltby Wood near Louth, April 1886 ! also roadsides, Bag Enderby, and old mill bank, Harrington Hill, Sept. 1889 ! Gayton-le-Wold, March 1896 ! Welton wood, Willoughby, May 1906 ! W. Denison Roebuck. Cleethorpes, Sept. 1887 ! H. W. Kew. Oxcombe, July 1902 ! C. S. Carter. Claxby, Apr. 1903 ! Rev. W. W. Mason.

Leicester—Hedge-bottoms, Anstey, Sept. 1885 ! H. E. Quilter.

Notts.—Common among damp moss and under stones (B. Sturges Dodd, Notts. List, 1893, p. 72). Highfield House, Sawley, Wollaton, etc. (Lowe and Musson, Notts. List, 1879). Cresswell Crags, Pleasley Vale, and Beauvale, April 1884 ! C. T. Musson.

Derby—Markland Grips, April 1884 ! C. T. Musson. Clifton near Ashbourne, Aug. 1889 ! Lionel E. Adams. Plentiful at Winsley, and in a small ravine, called Northerdale, at Snitterton near Matlock, 1885 ! H. E. Craven. Among moss-grown stones in an old watercourse above Poole's Cavern, Castleton, alt. 1,250 feet, Aug. 1900, Rev. R. Ashington Bullen. Abbotsholme, Oct. 1906 ! F. H. Sikes.

MERSEY.

Cheshire—Woods at Marple, 1869 ! Thomas Rogers. Marbury near Northwich, April 1902, C. Oldham. Type and var. *viridans*, Oakwood (J. W. Jackson, J. of Conch., July 1903, p. 336).

Lancashire S.—By stream-side, Smithies Bridge near Chatburn, Aug. 1885 ! W. D. Roebuck. Farington, Penwortham, Walton, Samlesbury, and Billington, 1889, W. H. Heathcote. Lords Wood, Whalley, E. Collier. Read near Burnley, and at Swinton, 1886, R. Standen.

Lancashire Mid—Found near Preston by Gilbertson about 1837 ! Rev. Dr. Norman. Rather common round Preston, Brockholes Wood near Preston, and found also at Elston, 1889, W. H. Heathcote. Near Fleetwood, Sept. 1890, also at Woodwell, Silverdale, Sept. 1905, R. Standen.

HUMBER.

York N.E.—Wilton Wood near Redcar, Aug. 1887 ! B. Hudson.

York S.W.—Near Doncaster (Roberts, Nat. Hist. of Lofthouse, 1882, p. 313). Anston Crags near Worksop, 1881 ! Edgar Pickard. Roche Abbey, April 1884 ! W. Denison Roebuck. On the magnesian limestone at Conisborough, July 1887 ! T. Rogers. Penistone, May 1890 ! L. E. Adams. Locally abundant about Doncaster ; very fine at Cusworth and Edlington (Corbett, Nat., June 1902, p. 205). Park Wood, Elland, July 1872 (F.R.P., Yorks. Nat. Recorder, Oct. 1872, p. 67). Nab Wood, Bingley, J. A. Hargreaves. Cottingley Bridge, J. W. Carter. Bramley-Fall Wood, Nov. 1890, A. Hartley. Keighley, June 1906 ! F. Booth. Not uncommon about Bradford, especially between Apperley and Shipley ; Buck Wood, Thackley, Dec. 1886, H. T. Soppitt. Near Huddersfield ! J. Whitwham. Kiveton Park, 1882 ! W. Nelson.

York Mid W.—In Airedale : Shadwell, April 1877 ! H. Crowther. Garforth, 1881 ! H. Pollard. Hawkesworth Wood, Horsforth, March 1887 ! W. Denison Roebuck. Crag Wood, Rawdon, 1884 ! W. Nelson. Roundhay, April 1879, H. Pollard. Skipton, 1880, J. Whitwham.

In Wensleydale : Ripon, April 1877 ! H. Crowther. Beech woods, Mickley, and Hackfall, Aug. 1889 ! W. Denison Roebuck. Fountains Abbey, May 1905 ! J. E. Crowther.

In Nidderdale : Below Castle Keep, Knaresborough, 1888 ! F. R. Fitzgerald.

In Wharfedale : Bolton Abbey, 1874 ! Reynard Ings near Ilkley, July 1873 ! Pool Bank, June 1880 ! Askwith near Otley ! by Arthington Viaduct, April 1882 ! and by Glaston Beck, Lindley Wood, April 1887 ! W. Denison Roebuck. Otley, 1889, F. Rhodes. Stockeld Park, Spofforth, Sept. 1889 ! Grassington, Sept. 1891 ! Collingham, 1874 ! Linton Springs near Wetherby, 1874 ! Boston Spa, 1885 ! and Bolton Percy, July 1880 ! W. Nelson.

In Ribblesdale : Long Preston ! Great Mytton Churchyard ! Whitewell ! and roadsides near Sawley, Aug. 1885 ! W. Denison Roebuck. Clapham, Sept. 1885 ; Helk's Wood, Ingleton, Aug. 1888, E. Collier. Swilla Bottom, Ingleton, 1890, F. Rhodes. Gisburn, "Thos. Rogers' Collection," F. H. Sikes.

York N.W.—Bracken Gill near Sedbergh, July 1887 ! Baker Hudson. Castle-Bolton, Aug. 1882 ! Low lane, Isles Bridge, near Reeth, Aug. 1885, and Kisdon Wood, Aug. 1890 ! W. Denison Roebuck.

TYNE.

Durham—East Thickley, July 1885 ! Baker Hudson.

Northumberland S.—West Woodburn, Sept. 1887 ! Richard Howse.

Westmorland and Lake Lancs.—Grasmere in 1846 (J. G. Jeffreys, Ann. and Mag. N.H., 1870, p. 385). Coniston, April 1887 ! S. C. Cockerell.

Cumberland—Wetheral, verified by Mr. Rogers (Miss Donald, Cumberland List, 1882, p. 56).

SCOTLAND.

WEST LOWLANDS.

Dumfries—Recorded by Mr. R. Rimmer (Land and Freshw. Shells of Brit. Isles, 1880, p. 101).

Ayr—Largs, July 1890 ! Alex. Shaw.

EAST LOWLANDS.

Roxburgh—Jedburgh, Sept. 1904 ! J. Roseburgh.

Stirling—Near Stirling, 1894 ! A. McLellan.

Perth S.—Nine specimens found by Mr. Scott, of the High School, Stirling, among sphagnum in flower-pots ; the sphagnum was gathered in a wood at Brucefield, Dollar (G. McDougall, Third Report on Shells of South Perth, etc., 1896).

EAST HIGHLANDS.

Banff—Banks of river Avon, Ballindalloch, June 1893 ! W. Evans.

WEST HIGHLANDS.

Main Argyle—Collected by Mr. Claremont at Oban in 1882, B. M. Oakshott.

Dumbarton—By Forth and Clyde canal, Maryhill, and Garscadden, July 1887 ! A. Shaw.

Clyde Isles—Port Bannatyne, Bute, Sept. 1887 ! Alex. Shaw. Whiting Bay, Isle of Arran, April 1906 ! F. H. Sikes.

Cantire—Machrihanish, Aug. 1897, C. W. Adams.

IRELAND.

ULSTER.

Monaghan—In "cutting" of Ulster canal, Smithborough, Aug. 1889 ! J. G. Milne.

CONNAUGHT.

Sligo—Sligo, July 1904 ! R. Welch and A. W. Stelfox.

MUNSTER.

Tipperary S.—Hill opposite Marlfield, Clonmel, Rev. A. H. Delap.

Waterford—Ditch at Greenan near Clonmel, Rev. A. H. Delap.

Cork S.—Found at Whitegate and Rochespoint by Mr. R. A. Phillips.

Kerry—Common at Bantry, Dr. R. F. Scharff. Kenmare, 1898 ! R. Welch.

GERMANY.

Saxony—Mr. F. H. Sikes found this species in Oct. 1904 at Loschwitz in Saxony ! and also in a small wood at Georgenthal, Thuringia, May 1904 !

BELGIUM.

Recorded for Belgium by Schepmann (Jahrb. Deutsch. Mal. Ges., July 1882).

FRANCE.

Recorded for Normandy by Dr. Jeffreys (Ann. and Mag. Hist., 1870, p. 345) ; for Brittany by Westerlund ; and has also been collected at Cabourg-sur-Mer in Calvados in 1885 by Mr. G. F. Payn ; while Mr. S. C. Cockerell found it at Rouen and plentifully at Veules-en-Caux, Seine Inférieure, August 1885 !

SWITZERLAND.

Rare at Weissenstein in Canton Solothurn ! (Blum, l.c.). Recorded as *Euhyalina subglabra* by Clessin for the Cantons of Lucerne and Zug, for Altorf in Canton Uri, and the Gorge of the Tamina in the Grisons.

AUSTRO-HUNGARY.

The *Hyalinia glabra* var. *striaria* recorded for Hochwald, Austria, by Prof. T. D. A. Cockerell, and from Transylvania and Galicia by Westerlund.

RUSSIA.

The *Hyalinia glabra* var. *striaria* recorded for Poland by Westerlund.



FIG. 87.—Margin of Marple Wood, Cheshire, the original locality in which '*Zonites glaber*' was discovered by Mr. Thomas Rogers (from a photograph by Mr. T. Baddeley).

Distribution of *Hyalinia helvetica* (Blum).

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

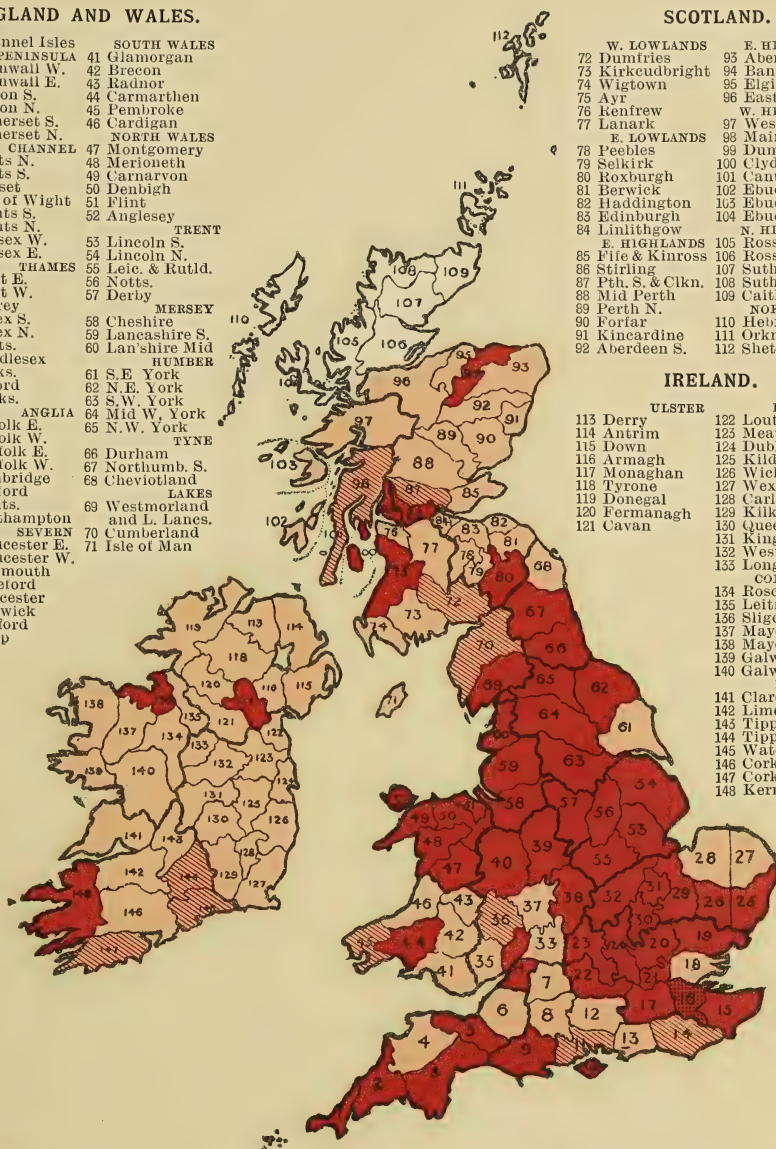
Channel Isles	SOUTH WALES
1 Cornwall W.	41 Glamorgan
2 Cornwall E.	42 Brecon
3 Devon S.	43 Radnor
4 Devon N.	44 Carmarthen
5 Somerset S.	45 Pembroke
6 Somerset N.	46 Cardigan
7 Wilts N.	NORTH WALES
8 Wilts S.	47 Montgomery
9 Dorset	48 Merioneth
10 Isle of Wight	49 Carnarvon
11 Hants S.	50 Denbigh
12 Hants N.	51 Flint
13 Sussex W.	52 Anglesey
14 Sussex E.	53 Lincoln S.
15 Kent E.	54 Lincoln N.
16 Kent W.	55 Leic. & Rutld.
17 Surrey	56 Notts.
18 Essex S.	57 Derby
19 Essex N.	MERSEY
20 Herts.	58 Cheshire
21 Middlesex	59 Lancashire S.
22 Berks.	60 Lancashire Mid
23 Oxford	HUMBER
24 Bucks.	61 S.E. York
25 Suffolk E.	62 N.E. York
26 Suffolk W.	63 S.W. York
27 Norfolk E.	64 Mid W. York
28 Norfolk W.	65 N.W. York
29 Cambridge	TYNE
30 Bedford	66 Durham
31 Hunts.	67 Northumb. S.
32 Northampton	68 Cheviotland
33 Gloucester E.	LAKES
34 Gloucester W.	69 Westmorland
35 Monmouth	and L. Lanes.
36 Hereford	70 Cumberland
37 Worcester	71 Isle of Man
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkeudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easterness
76 Kenfrew	W. HIGHLANDS
77 Lanark	97 Westerness
E. LOWLANDS	98 Main Argyre
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Pth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincairdine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry



Probable Range.

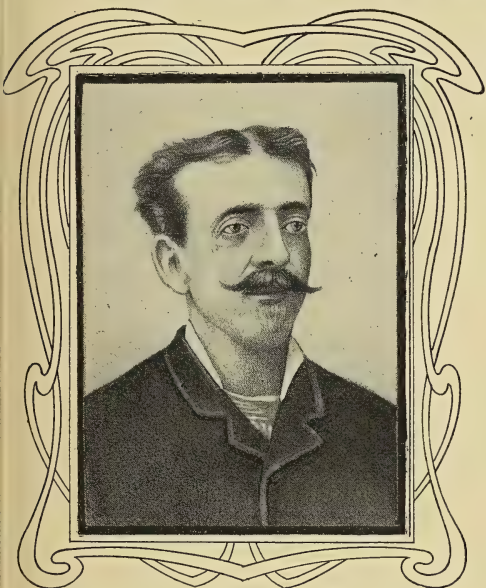
Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

Hyalinia alliariorum (Miller).

- 1822 *Helix alliariorum* Miller, Ann. Phil., N.S., iii., p. 379.
 1825 — *nitens* Sheppard, Linn. Trans., xiv., p. 160.
 1828 — *fatida* Stark, Elem. Nat. Hist., ii., p. 59.
 1830 — *alliacea* Jeffreys, Linn. Trans., xiii., p. 34.
 1851 — *remota* Benson, Ann. Nat. Hist., vii., p. 263.
 1837 *Helicella alliariorum* Beck, Ind. Moll., p. 6.
 1840 *Zonites alliariorum* Gray's Turton's Manual, p. 168.
 1877 *Hyalinia alliariorum* Westerlund, Faun. Eur. Moll. Extram., p. 20.
 1886 *Hyalina nitidiformis* De Castro, f. Bourguignat.
 1886 *Euhyalina alliariorum* Esmark, Journ. of Conch., v., p. 126.
 1891 *Vitrea (Polita) alliariorum* Smith, Journ. of Conch., vi., p. 339.

*José da Silva e Castro.*

HISTORY.—*Hyalinia alliariorum* (*allium*, garlic) was first differentiated by Mr. J. S. Miller, of Bristol, who applied to it the very appropriate name it bears.

The species is here associated as a token of respect to the well-known Portuguese conchologist, Senhor José da Silva e Castro, who independently recognized the claims of this mollusk to specific rank, and described it as new under the name of *nitidiformis*, the incorrect appreciation abroad of the true *alliariorum* explaining the renaming of a species already recognized in the nomenclature.

It has also been regarded by Mörch as identical with *H. nitida* O. Fabr., and with his own *H. steenstrupi* described as inhabiting Greenland and Iceland.

Though a fairly distinct shell in external aspect, and possessing certain peculiarities in the animal inhabitant it was unfortunately confused for many years with *H. helvetica*, and this regrettable confusion at home led to great misconception abroad, owing to our British scientists distributing shells among their foreign correspondents as *H. alliariorum* which in very many cases were really *H. helvetica*.

Moquin-Tandon's description and comments show that though he probably had the species before him, he did not separate it from *helvetica* and other forms, as he describes the species as attaining a maximum diameter of fifteen mill., and an altitude of six mill., sizes quite incompatible with the true *H. alliariorum*.

Dr. Jeffreys also confused *helvetica* with *alliariorum*, and there is little doubt that his figures of *alliariorum* were drawn from examples of *helvetica*.

The specific status of *H. alliariorum* has been the subject of much diversity of opinion, especially with continental naturalists, but that it is the young of *H. cellaria*, as held by Dr. Boettger, or of *Z. nitida* of Draparnaud, as thought by Michaud, or of the species here termed *H. helvetica*, as believed by others, is quite inadmissible.

That the species of the restricted group *Euhyalinia* should display a close affinity in their shells and general aspect, as well as present considerable conformity in their internal organization is quite naturally to be expected, and though there are ample and constant differences to justify the separation of the various recognised species, yet the general proportion and character of the different parts, as the direct course of the hermaphrodite duct; the position of the spermatheca and the length, tapering form, and peculiar flexure of its stem; the marked bending of the free oviduct; the form, position, and nature of the vaginal gland, and other characteristic peculiarities, make it abundantly evident that though the different species have undoubtedly finally parted company, they have not yet greatly diverged from a common ancestral type.

H. alliaria shows its individuality by the deep pigmentation of the animal extending even to the most remote internal parts; by the smell of garlic, from which its trivial name is derived, being so intense and permeating, and by the mantle margin constantly showing much slighter pigmentation than in *H. helvetica*; but what should weigh most heavily in the scale is the fact that these little shells of *alliaria*, barely six mill. in diameter, always contain sexually mature animals clearly exhibiting the characters of the species; while if specimens of *H. cellaria* or *H. helvetica* of the same size be examined, the reproductive organs in every case are quite rudimentary and undeveloped, and it is not until the shell becomes much larger and full growth nearly attained that these organs are perfected.

Diagnosis.—The SHELL of *H. alliaria* differs from that of *H. cellaria* in its smaller size, darker colour, greater convexity and thickness; the mouth also is less oblique, and the whitish basal opacity not so apparent; it has also one whorl less, and a more open umbilicus. From *H. helvetica* it is distinguished by its much smaller size and its much wider umbilicus.

The ANIMAL is characterized by its dark coloration, a feature also distinguishing *H. lucida*, differing thus from the much paler animals of *H. cellaria* and *H. helvetica*. It is also remarkable for its much greater power of exhaling the odour of garlic when annoyed or injured. The tail is short and only extends just beyond the shell during locomotion, contrary to what obtains in its close ally *H. helvetica*.

INTERNALLY, this species is strongly differentiated by the dark pigmentation of the body, which extends to more distant parts than in the kindred species, as the intestines, the oviduct, and the anterior portion of the œsophagus are all more or less affected; the somewhat globose spermatheca, the annulation around the base of the penis-sheath, and the absence of the milk-white arterioles of the liver, which are so conspicuous in *H. helvetica*, are also striking points of divergence.

Original Description.—“37 *Helix alliaria* (nobis). *Spec. char.*: An umbilicated, depressed, pellucid, horn-coloured shell, having no more than four volutions. *Observation*: This species never arrives to the size of *H. nitens*, has one volution less, and is found under moss on old trees. Its inhabitant smells strongly of garlick.”—J. S. MILLER, *Annals of Phil.*, May 1822, iii., p. 379.

Description.—ANIMAL with body rounded in front, with short and pointed TAIL, scarcely extending beyond the shell during locomotion; the BODY is of a slaty blue-black above, darkest towards the head, the deep pigmentation is bounded below by the LATERAL GROOVES, which extend from the RESPIRATORY ORIFICE to beneath the LOWER TENTACLE on the right side of the body, and occupies a similar position on the left side of the body; the two DORSAL GROOVES are distinct and

widely separated, and from them fall to the lateral grooves a series of zebra-like markings, faintly perceptible by transmitted light, and between which are flat and irregularly shaped RUGOSITIES; below the lateral grooves the TUBERCLES are rounded and few in number, and the colouring is a translucent grey, paling as it approaches the foot margin and the junction with the MANTLE; OMMATOPHOES almost black, rather short and thick, slightly more slender before bulbous apical enlargement; RETRACTORS show as a dark line down the ommatophores and along the back; the SOLE is trifasciate, the side areas are separated from the median area by distinct longitudinal grooves, and partake of the general dark pigmentation of the body.

SHELL depressly convex above, but more compressed below than in *Hyalinia helvetica*; WHORLS 4-4½, semi-transparent, glossy and smooth, with faint but regular striation in the line of growth, most pronounced at the sutures; of an amber or horn colour above, passing imperceptibly into a whitish basal opacity; umbilicus about a mill. in diameter, distinctly showing the penultimate whorl, and comparatively much wider than in *H. helvetica*; whorls regularly increasing in size; spire somewhat elevated; suture distinct but not deep; aperture crescentic and somewhat oblique, with a thin and sharp peristome.

Diam., maj. 6 mill., min. 5 mill. Alt., 2½ mill. Average weight of adult shells about ⅓rd of a grain.

When retracted within the shell, the upper side appears of a dark dusky-brown, with a slender slightly blackish line at the margin of the collar; the under-side is yellowish-brown up to the yellowish renal organ, beyond which to the aperture the colouring is blackish.

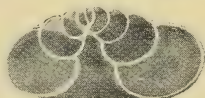


FIG. 89.—Section through the shell of *H. alliaria* to show the shape and character of the whorls and umbilical cavity $\times 4$ (from a preparation by Mr. F. Rhodes).



FIG. 90.



FIG. 91.



FIG. 92.



FIG. 93.

Anatomical details of *Hyalinia alliaria* (Miller), from specimens collected at Redcar by Mr. B. Hudson.

FIG. 90.—Nerve ring of *Hyalinia alliaria* (Miller), as viewed from the rear, showing otocysts, $\times 20$.

FIG. 91.—Nerve ring of *H. helvetica* (Miller), as viewed from the right-side, showing otocysts, $\times 20$.

FIG. 92.—Pedal ganglia of *Hyalinia alliaria* (Miller), highly magnified, showing the otocysts.

ot. otocyst; cc. cerebro-pedal connective.

FIG. 93.—Otoconia of *Hyalinia alliaria* (Miller), highly magnified.

The ALIMENTARY CANAL is of the usual triodromous type, not differing essentially from that of the congeneric species; the white and compact SALIVARY GLANDS are attached to and surround the long and slender CESOPHAGUS; the CROP is scarcely distinct from the stomach, with which externally it apparently gradually blends, and the LIVER or digestive gland is more compactly lobed than in *Hyalinia cellaria*.

The REPRODUCTIVE ORGANS show a whitish OVOTESTIS, composed of a few scattered clusters of follicles; HERMAPHRODITE DUCT long, slender, and not convolute; ALBUMEN GLAND broadly linguiform; OVIDUCT light grey, with ample folds; SPERM-DUCT narrow above, much wider below; VAS DEFERENS showing the usual enlargement in the latter half of its course, and entering the somewhat arcuately fusiform EPIPHALLUS near the centre; the PENIS-SHEATH is separated from the epiphallus by a distinct constriction, and gradually increases in calibre, culminating in a broad and protruding ANNULUS to which the vas deferens is bound by muscular tissue, afterwards contracting to open into the short ATRIUM; the retractor muscle of the epiphallus is terminal, rather long, and attached to the oviduct; the free-oviduct increases in size as it approaches the sexual orifice; the SPERMATHECA is very broadly oval or almost spherical, with reddish-brown core, its duct is very slender above, but thickens below, its junction with the oviduct being hidden beneath the largely developed VAGINAL GLAND, by which the oviduct is enveloped.



FIG. 94.



FIG. 95.



FIG. 96.



FIG. 97.

FIG. 94.—Alimentary canal of *Hyalinia alliaria* (Miller), $\times 6$.

FIG. 95.—Proximal end of the reproductive organs of *Hyalinia alliaria* (Miller), $\times 6$.

FIG. 96.—Penis-sheath, epiphallus, and the enlarged tract of the vas deferens of *Hyalinia alliaria* (Miller), $\times 20$ (after a photograph by Mr. W. Moss).

FIG. 97.—Ovotestis of *Hyalinia alliaria* (Miller), $\times 20$.

The MANDIBLE or jaw is about half-a-mill. from side to side, and in the described specimen not thick, strong and dark coloured, but somewhat thin and amber coloured; the shape is almost lenticular, the upper margin being well arched, but slightly recurved at the ends; the lower margin is also sinuously convex, the most prominent part being the projecting median beak or rostrum. The whole jaw is arcuate from front to back, the rostrum being a somewhat prominent but indistinctly defined vertical ridge, and the line of insertion in the tissues on the upper margins is clearly shown, but the transverse and converging vertical striation is very fine.



FIG. 98.—Mandible or jaw of *Hyalinia alliaria*, $\times 25$.
(Coatham, Mr. B. Hudson).

The LINGUAL MEMBRANE is about two mill. long, and about half-a-mill. wide, with about thirty-five curved transverse rows of teeth, each row being constituted by a small tricuspid median tooth, bearing a long, slender, and well developed mesocone with a slightly projecting ectocone at each side; the two strictly lateral or admedian teeth have strong and powerful cutting points to the mesocone and endocone, but the ectocone on both these teeth does not show as a single and simple cusp, but is distinctly serrate on both teeth, the second admedian showing at times a subsidiary ectoconic point; the third lateral is transitional and has all the characters of the aculeate marginals except that a strongly developed endocone is present; the marginal teeth are strictly aculeate and vary in number from nine to twelve on each side.

Herr Schepmann, however, in a specimen ascribed to this species, from Nordhausen, represents this transitional tooth as also possessing a distinct ectocone, but this feature has not yet been observed in British specimens.



FIG. 99.—Transverse row of teeth from the odontophore of *Hyalinia alliaria* (Miller), $\times 200$. The animal collected at West Kilbride, Ayrshire, by Mr. A. Somerville, and the palate prepared by Mr. J. W. Neville.

The formula of a Coatham specimen, collected by Mr. Baker Hudson and prepared by Mr. J. W. Neville, is

$$\frac{10}{1} + \frac{1}{2} + \frac{2}{3} + \frac{1}{3} + \frac{2}{3} + \frac{1}{2} + \frac{10}{1} \times 35 = 945.$$

Habits and Habitats.—*Hyalinia alliaria* is a local and gregarious species, and though occasionally found in almost every variety of situation is said by Mr. Swanton to be more plentiful on Neocomian strata than any of its congeners. It, however, habitually frequents bleaker and more

Westmorland and Lake Lancashire—Eggerslack Wood, Grange-over-Sands, Aug. 1898, R. Standen.

Isle of Man—Nunnery grounds, Douglas, Oct. 1883 ! E. Collier. Ramsey Head near Peel, Aug. 1891, R. Cairns.

SCOTLAND.

Renfrew—Cloch near Greenock, June 1885, T. Scott.

Haddington—Bass Rock ! commoner than type, Rev. Dr. McMurtrie.

Edinburgh—With type, Harmony near Balerno ; near Dalhousie, Dalmahoy and Kirknewton ! W. Evans.

Stirling—Bardowie Loch, June 1889 ! Alex. Shaw.

Perth S. and Clackmannan—Abbey Craig, G. McDougall.

Main Argyle—In wood by Kerrera Sound, Oban, with type, Nov. 1886 ! Rev. J. E. Somerville. Pine wood, south of Oban, August 1893 (Standen and Hardy, Journ. of Conch., Oct. 1893, p. 269).

Clyde Isles—Side of Loch Fad, Bute, May 1887 ! T. Scott. Whiting Bay, Arran, Apr. 1906 ! F. H. Sikes.

Hebrides—Abundant with type, especially on the slopes of Bernahaig, Island of Hirta, July 1905 ! J. Waterston.

Orkneys—Birsay, Dec. 1890 ! W. Evans. Mainland and South Ronaldshay, Aug. 1905 ! Rev. R. Godfrey.

Shetlands—Shetland, 1861 ! Rev. Canon Norman.

IRELAND.

Derry—Common at Coleraine, Nov. 1883 ! and very common about the ruined church of Ballywillan by Portstewart, April 1884 ! Lionel E. Adams. Swarms with type on the mossy dunes by the sea along all the North Derry coast, R. Welch.

Antrim—Cushendun, April 1886 ! Rev. S. A. Brennan. The type and variety about equally abundant throughout the Ballycastle district at Murlough, Glenshesk, and in pockets at Whitepark, Sept. 1896 (R. Standen, Irish Nat., Jan. 1897, p. 4). Type and variety at Ushet Point, Rathlin Island, Sept. 1896 (L. E. Adams, Irish Nat., July 1897, p. 180).

Down—Near Newry, March 1904 ! P. H. Grierson.

Armagh—Armagh, Dec. 1904 ! Newry, July 1905 ! P. H. Grierson.

Tyrone—Recorded by Jeffreys (Brit. Conch., l.c.). Baron's Court, Sept. 1904 ! R. Bell.

Donegal—Found in 1894 by Mr. R. Standen.

Cavan—Kingscourt, June 1904 ! P. H. Grierson.

Louth—Beaulieu, Oct. 1904 ! Narrow Water, Dec. 1904 ! Townley Hall, May 1905 ! P. H. Grierson.

Meath—Bective Abbey, Mar. 1905 ! near Drogheda, May 1905 ! P. H. Grierson.

Kildare—Near Straffan station ! P. H. Grierson.

Wicklow—Powerscourt Waterfall, April 1904 ! P. H. Grierson.

Kilkenny—Callan ; Ullard ; and near Waterford, 1903 ! P. H. Grierson.

Galway W.—Dernasluggan, with type, April 1897 ! R. Welch.

Clare—Leamenagh and Lahinch, 1900 ! P. H. Grierson.

Waterford—Tramore ; Mount Congreve ; Cappoquin and near Youghal, autumn, 1902 ! P. H. Grierson.

Cork N.—In some plenty near Roche's Point and Trabolgan, but no type forms found (A. R. Phillips, Cork List, 1894).

Kerry—Great Skellig, the variety only (R. F. Scharff, Irish Nat., Jan. 1898, p. 11). Plentiful with type in St. Finan's Graveyard ; Kenmare Demesne ; Mucksna Wood ; Galway's Bridge, R. Welch.

Scandinavia—Rare (Westerlund, Syn. Moll. Extram. Scand., 1897, p. 37).

Var. **schepmanni** Westl., Faun. Paläarkt. Reg. Binnenconch., 1886, p. 53.

Hyalinia alliaria var. *schepmanni* Westerlund, l.c.

SHELL very compressed and flat, very smooth, thin, and glossy ; whorls $5\frac{1}{2}$; umbilicus open ; aperture broadly crescentic. Diam., 8 ; alt., 3 mill.

Holland—Rhoon near Rotterdam (Westerlund, l.c.).

Var. **cantabrica** Westl., Faun. Paläarkt. Reg. Binnenconch., 1886, p. 53.

SHELL narrowly umbilicated, horny-olive above, paler beneath ; whorls, 6-6 $\frac{1}{2}$, regularly and quickly increasing ; aperture sharp, crescentic ; whorls convex, with somewhat prominent apex. Diam. 10-12 mill. ; alt. 5-6 mill.

Spain—Bilbao in the Basque provinces (Westerlund, l.c.).

Var. **cuprea** Westl., Faun. Paläarct. Reg. Binnenconch., 1886, p. 53.

SHELL larger and stronger, not so glossy, ruddy-brown, sometimes whitish beneath; aperture more descending.

This is given by Westerlund as subsidiary to his *H. cantabrica*.

Spain—Bilbao in the Basque province (Westerlund, l.c.).

Var. **suballiaris** Bourguignat in Pechaud's Exc. Malac., 1883, p. 21.

SHELL more openly umbilicated than the type, and the suture finely wrinkled, last whorl strongly developed, and the mouth more obliquely elongated.

Algiers—(Bourguignat, l.c.).

Var. **aquitana** Charpentier.

SHELL similar in size and convexity to *H. glabra*, but with a wider umbilicus.

France—Department of the Landes (Von Martens, Die Heliceen, 1860, p. 69).

Italy—Tuscany (Westerlund, Faun. Eur. Moll. Extram., 1877, p. 20).

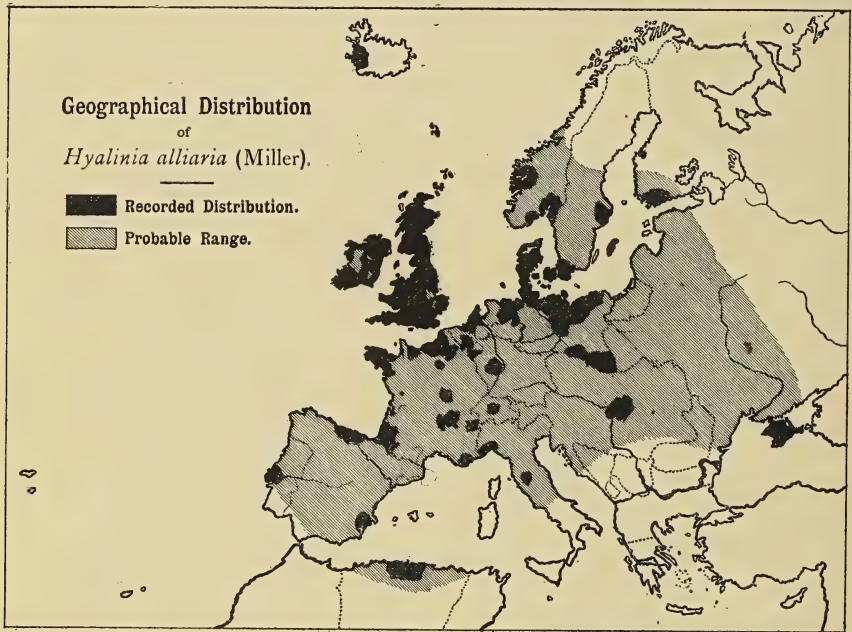


FIG. 100.

Geographical Distribution.—*H. alliaris* is another species concerning which a great amount of misapprehension has existed, and this unfortunately has led to an amount of uncertainty as to the reliability or otherwise of many of the records, especially when the remarks which sometimes accompany them are studied.

Judging by the records, this species has a wide European distribution, and this is probably really the case, though a thorough knowledge of its distribution is probably obscured, as it has far too often been regarded as an immature stage of some of the larger species, but it is hoped that the ample details of its structure now furnished will lead to its inhabited area becoming more accurately known.

In the British Isles it is a well distributed species from the Shetland to the Channel Isles, and there are few comital areas from which specimens have not been seen and verified.

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MONOGRAPH
OF THE
LAND & FRESHWATER
MOLLUSCA
OF THE
BRITISH ISLES.

JOHN W. TAYLOR.

203527

Part 15 (pp. 65-144; and pls. ii., vii., viii., ix., and x.), **Price 7/6.**
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(Continued from Part 14)

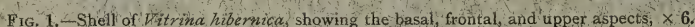
Birmingham Natural History Society, Birmingham.
Boston Society of Natural History, Boston, Mass., U.S.A.
Chadwick, A., St. Mary's Cathedral, Newcastle.
Educational Depository, Kildare Place, Dublin.
Going, Rev. J., Harford House, Purton.
Gurney, R., F.Z.S., Ingham Old Hall, Stalham.
Huggins, H., 13, Clarence Road, Gravesend.
Leicester Museum and Art Gallery.
Marquis Monterosato, Via Gregorie, Palermo.
Reh, Dr., Naturhistör. Museum, Hamburg.
Steenberg, C. M., Observatory, Copenhagen.
Thaanum, D., Hilo, Hawaii.
Taylor, J. Kidson, 45, South Avenue, Buxton.

Vitrina elongata Taylor, Irish Nat., Aug. 1907, pp. 225-231, and pl. 26 (not Drap.).
Vitrina pyrenaica Bowell, Irish Nat., May 1908, pp. 94-98, and pl. 4 (not Fér.).

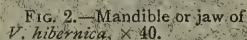
In August 1907, I brought forward as new to the British Isles, a *Vitrina* found at Collon in county Louth by Mr. P. H. Grierson, which, from an examination of the shell only, I referred to *Vitrina elongata*, a species found chiefly in the Alpine regions of Europe. Since that time, through the efforts of the discoverer and other collectors, living specimens have been obtained and have been carefully examined and studied in collaboration with Dr. Simroth, of Leipzig, our greatest authority on this group, who is chiefly responsible for the dissections of the reproductive system.

The result of the anatomical investigations show that the Irish specimens, though intimately allied to *V. elongata*, are yet quite distinct, and they are now distinguished as a new species, for which *V. hibernica* is an appropriate name.

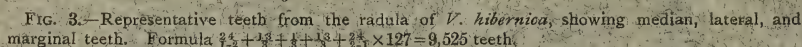
The description of the ANIMAL and SHELL is omitted here, the internal organization only being given.



The JAW or mandible is of an amber colour, flatly crescentic in shape, with distinctly recurved ends; it exceeds half-a-millimetre in length from side to side, and is of the usual oxynathous type, with a strong chitinous projection or elasma behind; the median rostrum or beak is blunt and not prominent, with somewhat distinct vertical striae, which are continued upon the chitinous posterior prolongation; the remaining anterior surface of the mandible shows indications of striae more or less parallel with the upper margin.



The RADULA is of the usual oblong shape, and in the specimen figured is composed of about 127 rows of 73 teeth each. The median row is distinctly tricuspid, a long and somewhat slender mesocone being flanked by a pair of comparatively insignificant ectocones; the laterals are thirteen in number, and also tricuspidate, the ectocone being more basally placed and more strongly developed than the endocone, which gradually diminishes in size and prominence; the inner marginals



are bifid, the endocone of the lateral teeth having become obliterated, and the ectocone also being much reduced in importance until at about the twentieth row it also disappears and the teeth become simply aculeate, the extreme outermost rows being quite rudimentary.

GERMANY.

According to Herr Clessin this species is only found in Northern Germany. While Kobelt, on the contrary, describes it as absent from North and Mid Germany. It has, however, been definitely recorded as follows:—

Anhalt and Merseburg—Recorded by Schepmann for Nordhausen, and by Clessin for the Harz Mountains.

Brandenburg—Neustadt-Eberswalde, and about Berlin (Reinhardt and others).

Bremen—From north-west Germany between the Elbe and the Ems (Borchering, Abh. Ver. Bremen, viii., 1882).

Hanover and Lippe—Recorded by Clessin from Lemgo in Lippe Detmold.

Holstein—Kiel, Hamburg, and Eutin (Clessin and others).

Mecklenburg—Recorded from Mecklenburg by Von Martens.

Oldenburg and Osnabruck—From north-west Germany between the Elbe and the Ems (Borchering, l.c.).

Pomerania—Hökendorf, Crieven, and Heringsdorf, and the Islands of Wollin and Rügen (Lehmann and others).

Rhine Palatinate—Neustadt (Clessin, op. cit.).

Schleswig—Flensburg (Clessin, op. cit.). Very common at Rödding (Schlesch, Ann. Soc. Roy. Zool. and Mal. Belg., 1907, p. 46).

Silesia—Hirschberg and the Sudeten (Loens and others).

Westphalia N.—Recorded from Porta Westphalica and Jacobsberg near Minden, and the Island of Heligoland (Pfeffer and others).

NETHERLANDS.

Holland—A single immature shell, near the Sapinières, Selzaete, May 1871 (Broeck, Bull. Soc. Mal. Belg., 1871, p. 40); and Westerlund records the var. *schepmanni* from Rhoon, near Rotterdam.

Belgium—A single specimen in a beech wood, Roumont, Luxemburg (J. C. Purves, Bull. Soc. Mal. Belg., 1870, p. 49); also at Brussels in Brabant (Broeck, Bull. Soc. Mal. Belg., 1871, p. 41).

FRANCE.

Ain—Terver records it for Bugey, rare (Locard, Moll. Ain, 1881, p. 25).

Aisne—Forest of Riz (Lallemand and Servain, 1869, p. 14).

Basses Pyrénées—Mabille records it from Bayonne and St. Jean de Luz.

Calvados—Recorded and figured from Calvados by Kobelt, Icon., 1878, p. 36.

Côtes-du-Nord—Under stones by the forts, and in the Ferrugineous Valley, Dinan (Bourguignat, Mal. Bret., 1860, p. 127).

Côte d'Or—Very rare, under moss, Prairie du Moulin de la Bruyère (Wattebled, Journ. de Conch., 1889, p. 313).

Finistère—On rocks, by Prefecture, Quimper (Bourguignat, Mal. Bret., 1860, p. 91). By the marsh at Kerloch, near Dinant; and by the fortifications at Brest (F. Daniel, Journ. de Conch., 1883, p. 379).

Hautes Pyrénées— Lourdes (Fagot, Hist. Mal. Pyr. Franç., 1880, p. 7).

Landes—Recorded from Dax by Grateloup (Jeffreys, Brit. Conch., 1862, p. 162).

Loire—Woods, Mont Pilat, near Lyons (Locard, Moll. Lyons, 1877, p. 15).

Morbihan—Tour d'Elven (Taslé, 1867, p. 54).

Pas-de-Calais—Boulogne-sur-Mer (Mabille, Journ. de Conch., 1865).

Rhône—Found by Terver at Lyons (Jeffreys, l.c.).

Savoy—(Clessin, op. cit.).

Seine—Mabille t. G. K. Gude.

Seine Inférieure—Abundant, Veules-en-Caux, Aug. 1885! S. C. Cockerell.

Somme—Bizet t. G. K. Gude.

Var—Toulon (Jeffreys, Brit. Conch., v., 1869, p. 157).

SWITZERLAND.

Found by Dr. Scharff on the Brunig Pass, Canton Unterwalden.

AUSTRO-HUNGARY.

Galicia—Recorded by Bakowski.

Hungary—Recorded by Locard (Mal. Lyon, 1877, p. 16); and by Hazay as *Hyalina cellaria* var. *alliaria* Millet, from various points of the Tatra in the Carpathians, but the dimensions quoted for the specimens—13 mill.—would seem to preclude this species (Jahrb. Mal. Ges., 1885, p. 25).

ITALY.

Schneider records the typical form from San Remo in Liguria; and Westerlund the var. *aquitana* Ch. from Tuscany.

SPAIN AND PORTUGAL.

Spain—Recorded for the province of Murcia, on the authority of Schmidt; and the var. *cantabrica* Westl. from Bilbao in the Basque provinces.

Portugal—Reported by Bourguignat under the name of *Hyalinia nitidæformis*, as ranging from Portugal to England.

SCANDINAVIA.

Norway—Dr. Jeffreys records this species from Bergen; and G. O. Sars from Christiania; while Westerlund mentions Arendal, Modum, Hole, Norderhoug, Herstad, etc., and Miss Esmark says it is uncommon, and adds to the known localities Ringerige and Laurvik, in Christiania, and Lillesand in Christiansand.

Sweden—Hartmann records it from about Stockholm; and Westerlund from the provinces of Skane, Blekinge, Ostergotland, Westergotland, Orebro, and Sodermanland, as well as from the vicinity of Stockholm, and the Botanical Gardens at Upsala. The sub-var. *anceps* has been found at Lund and the Island of Gothland.

Denmark—Westerlund records it as existing in many localities in the islands and on the peninsula. Schlesch remarks that it is spread over all Denmark, though everywhere sparingly. He especially cites as localities Frederiksdal, Ordrupe, Taarnby, and Valby, all near Copenhagen. He also reports it as very common on the Isle of Bornholm.

Iceland—Recorded from the west coast by Mörch (J. de Conch., 1876, p. 212).

Faroës—Occurs at Thorshavn, Tage, and Suderö, H. Schlesch, 1907.

RUSSIA.

Recorded by Luther for South-west Finland, and has also been recorded for the Crimea (Mal. Bl., 1881).

NORTH AFRICA.

Algiers—The var. *suballiaris* is recorded from Algiers by Westerlund.

ATLANTIC ISLES.

St. Helena—Wollaston (Test. Atl., p. 536) describes this species as now established on the island, and ascending to the highest parts of the great central ridge, and it is now said to be universally distributed above 2,000 ft. elevation, particularly in the dampest parts, under stones and moist rotten wood and among the cabbage trees. Mr. Benson, who found it in 1832 between Plantation and Stitch's Ridge, as well as in the valley, near Napoleon's Tomb, described it as new under the name of *Helix remota*. Mr. Layard also found it between Jamestown and Longwood.

NEARCTIC REGION.

Greenland—Frederiksdal in South Greenland, 1906, H. Schlesch.

United States—Park's Nursery, Brooklyn, New York, Thos. Bland (specimens in the Binney Collection, Washington). Found in a greenhouse at Boulder, Colorado, Jan. 1907, by G. H. Mason (T. D. A. Cockerell).

AUSTRALASIAN REGION.

New South Wales—The *Zonites nitidus*, recorded by Mr. C. T. Musson on the authority of Mr. Brazier as often found in hot-houses, should be referred to the present species, Mr. Musson himself concurring in this correction.

New Zealand—Recorded as *Zonites nitidus* from beneath logs by Lake St. John, Auckland, by Mr. C. T. Musson. Mr. W. Denison Roebuck found it plentifully in Feb. 1905 at Tapuwaecharuru Spa, within a hundred yards of the hot sulphur stream which, at a temperature of 106° Fahr., flows through the Spa Valley! Sandhills, Taranaki! H. Suter. At the roots of a New Zealand species of *Adiantum* in a greenhouse in Wellington! Miss M. Mestayer, 1905. All these localities are in the warm North Island.

Autograph of Mr. J. S. Miller, the discoverer of *H. alliaria*.

Distribution of *Hyalinia alliaria* (Miller)

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles		SOUTH WALES
PENINSULA	41	Glamorgan
1 Cornwall W.	42	Brecon
2 Cornwall E.	43	Radnor
3 Devon S.	44	Carmarthen
4 Devon N.	45	Pembroke
5 Somerset S.	46	Cardigan
6 Somerset N.		NORTH WALES
CHANNEL	47	Montgomery
7 Wilts N.	48	Merioneth
8 Wilts S.	49	Carnarvon
9 Dorset	50	Denbigh
10 Isle of Wight	51	Flint
11 Hants S.	52	Anglesey
12 Hants N.		TRENT
13 Sussex W.	53	Lincoln S.
14 Sussex E.	54	Lincoln N.
15 Kent E.	55	Leic. & Rutld.
16 Kent W.	56	Notts.
17 Surrey	57	Derby
18 Essex S.		MERSEY
19 Essex N.	58	Cheshire
20 Herts.	59	Lancashire S.
21 Middlesex	60	Lancashire Mid
22 Berks.	61	S.E. York
23 Oxford	62	N.E. York
24 Bucks.	63	S.W. York
ANGLIA	64	Mid W. York
25 Suffolk E.	65	N.W. York
26 Suffolk W.		TYNE
27 Norfolk E.	66	Durham
28 Norfolk W.	67	Northumb. S.
29 Cambridge	68	Cheviotland
30 Bedford		LAKES
31 Hunts.	69	Westmorland
32 Northampton		and L. Lanes
SEVERN	70	Cumberland
33 Gloucester W.	71	Isle of Man
34 Gloucester E.		
35 Monmouth		
36 Hereford		
37 Worcester		
38 Warwick		
39 Stafford		
40 Salop		

SCOTLAND.

W. LOWLANDS		E. HIGHLANDS
72 Dumfries	93	Aberdeen N.
73 Kirkcudbright	94	Banff
74 Wigtown	95	Elgin
75 Ayr	96	Easternness
76 Renfrew		W. HIGHLANDS
77 Lanark	97	Westernness
E. LOWLANDS	98	Main Argyll
78 Peebles	99	Dumbarton
79 Selkirk	100	Clyde Isles
80 Roxburgh	101	Cantire
81 Berwick	102	Ebudes S.
82 Haddington	103	Ebudes Mid
83 Edinburgh	104	Ebudes N.
84 Linlithgow		N. HIGHLANDS
E. HIGHLANDS	105	Ross W.
85 Fife & Kinross	106	Ross E.
86 Stirling	107	Sutherland E.
87 Pth. S. & Clkn.	108	Sutherland W.
88 Mid Perth	109	Caithness
89 Perth N.		NORTH ISLES
90 Forfar	110	Hebrides
91 Kincardine	111	Orkneys
92 Aberdeen S.	112	Shetlands

IRELAND.

ULSTER		LEINSTER	
113 Derry	122 Louth		
114 Antrim	123 Meath		
115 Down	124 Dublin		
116 Armagh	125 Kildare		
117 Monaghan	126 Wicklow		
118 Tyrone	127 Wexford		
119 Donegal	128 Carlow		
120 Fermanagh	129 Kilkenny		
121 Cavan	130 Queen's Co.		
	131 King's Co.		
	132 Westmeath		
	133 Longford		
	CONNAUGHT		
	134 Roscommon		
	135 Leitrim		
	136 Sligo		
	137 Mayo E.		
	138 Mayo W.		
	139 Galway W.		
	140 Galway E.		
	MUNSTER		
	141 Clare		
	142 Limerick		
	143 Tipperary N.		
	144 Tipperary S.		
	145 Waterford		
	146 Cork N.		
	147 Cork S.		
	148 Kerry		

Probable Range.

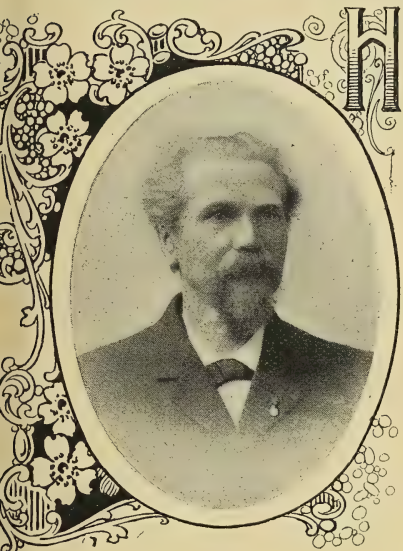
Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

SUB-GENUS *Polita* Held.**Hyalinia nitidula** (Draparnaud).

- 1805 *Helix nitidula* Draparnaud, Hist. Moll. France, p. 117.
 1831 — *nitens* Michaud, Compl., p. 44, pl. xv., f. 1-3.
 1837 — *helmi* Gilbertson ms., Alder, Mag. Zool. and Bot., p. 107.
 1833 *Oxychelus nitidulus* Fitz., Syst. Verz., p. 100.
 1837 *Helicella nitidula* Beck, Index Moll., p. 6.
 1837 *Polita nitidula* Held in Isis, p. 916.
 1840 *Zonites nitidulus* Gray, Turton's Manual, p. 172, pl. xii., f. 136.
 1869 — *subnitens* Bourguignat, Not. sur Zonites.
 1876 *Hyalina nitidula* Weinland, Weichth. Schwab. Alb., p. 35.
 1871 — (*Euhyalina*) *nitidula* Kobelt, Catal. Eur. Binnenconch., p. 5.
 1877 *Hyalinia nitidula* Westerlund, Faun. Eur. Moll. Extram., p. 24.
 1891 *Vitrea (Polita) nitidula* Smith, Journ. of Conch., vi., p. 339.



HISTORY.—*Hyalinia nitidula* (*nitidula*, not very glossy) is the type of the section *Polita* of Held, and is distinguished externally from *Euhyalinia* by the comparatively dull and lustreless surface of the shell as well as by the obsolete dorsal and lateral body grooves of the animal.

Internally, the odontophore shows a distinct central area of approximately equal-sized teeth, and a greatly increased number of marginal teeth, with an absence of the medial expansion of the vas deferens which is so conspicuous a feature in the *Euhyalinix*.

The present species is here associated with Heer M. M. Schepmann, of Rhoon, near Rotterdam, who has so thoroughly studied the dentition of the present and allied species.

H. nitidula was first properly differentiated by Draparnaud, whose description is especially applicable to the form with the less expanded aperture, which is

regarded by many continental conchologists as merely the young and incomplete state of the *Helix nitens* of Michaud, which name they therefore propose to substitute for the prior one of Draparnaud; other authors, on the contrary, regard the two forms as distinct species.

Diagnosis.—The shell of *Hyalinia nitidula* may be distinguished from those of *H. cellaria* and *H. helvetica* by its smaller size, by possessing one whorl less, and a much wider umbilicus, as well as by its dull and waxy appearance, and the marked expansion of the last whorl as it approaches the aperture.

The ANIMAL is remarkable for the indistinct or deficient dorsal and lateral grooves, the strong dorsal tuberculation, and thicker tentacles.

INTERNALLY, this species may be separated from all the preceding species by the absence of the medial enlargement of the vas deferens and vaginal glands, as well as by the much greater number of the marginal teeth.

Original Description. — "*H. nitidula*, *H. testâ* depressâ, pellucidâ, nitidâ, cornêâ, suprâ lutescente, subtûs albida; anf. quatuor."—J. P. R. DRAPARNAUD, Hist. Nat. Moll. France, 1805, p. 117.

Description.—The ANIMAL has an elongate body, blunt in front and attenuate behind, of a pale blackish-grey colour varying to a glossy black, and covered with irregularly-shaped tubercles which are minutely speckled on the summits with a darker shade and arranged in four somewhat indefinite longitudinal lines, but sharply separated at the level of the ommatophores from the paler slaty-grey area of the sides, where the rows of tubercles have an obliquely descending direction; DORSAL and LATERAL GROOVES indistinct and not observed; MANTLE grey; FOOT-SOLE tripartite, yellowish, narrowly margined with grey; OMMATOPHORES finely granulated, moderately long and thickish, especially at the base, slightly bulbous at the end, with scarcely perceptible EYE-SPOTS; the RETRACTORS show black through the skin and also appear as two broad distinct black stripes on each side of the back; LOWER TENTACLES about one-fourth the length of the upper pair and translucent at the tip; MUCUS watery and abundant.

The SHELL is depressly convex above, slightly more convex beneath; of a dull brownish-horn colour above, with an opaque whitish area around the umbilicus, the transverse striation somewhat distinct and regular, and the spiral striae also more regular and distinct than in *H. cellaria*; but the embryonal whorls are simply shagreened; epidermis thickish and giving the colour to the shell; whorls $4\frac{1}{2}$ –5, convex and rounded, the last expanded laterally as it approaches the mouth; spire slightly raised; suture well marked; mouth rounded-oval except where interrupted by the preceding whorl; umbilicus wide, even in the young, but becoming very openly umbilicated as the shell approaches maturity.

Diam., 8 mill. ; alt., 4 mill.

INTERNALLY, the HEART is white in colour, and the VENTRICLE much larger and more voluminous than the AURICLE, while the KIDNEY or renal organ is of a clear buff, overspread with vein-like markings springing from the cardiac side.

The REPRODUCTIVE ORGANS show the OVOTESTIS elongate with compact acini; the HERMAPHRODITE DUCT is not convolute, and is thickest as it approaches the long and slightly twisted VESICULA SEMINALIS; ALBUMEN GLAND yellow, large,



FIG. 103.—Section through the shell of *Hyalinia nitidula* to show the shape and character of the whorls and umbilical cavity, $\times 3$ (from a preparation by Mr. F. Rhodes).



FIG. 104.



FIG. 105.



FIG. 106.

FIG. 104.—Alimentary canal of *Hyalinia nitidula* sub-var. *helmii* $\times 4$, showing the salivary glands and the terminal flexure.

FIG. 105.—Pharyngeal and tentacular retractors of *Hyalinia nitidula* var. *nitens*, enlarged (after Simroth).

FIG. 106.—Sexual organs of *Hyalinia nitidula* (Drap.) $\times 4$.

a.g. albumen gland; ot. ovotestis; ov. oviduct; p.s. penis sheath; sp. spermatheca; sp.d. sperm duct; v.d. vas deferens.

and linguiform; the OVIDUCT is greyish-white and distinctly sacculated; the SPERM DUCT distinct and broad; the VAS DEFERENS is short and without a trace of the medial enlargement so characteristic of the *Euhyaliniae*; PENIS-SHEATH very

thick and bulky, abruptly flexed at the free end, but showing little evidence of an epiphallus; the vas deferens enters nearly terminally, and the retractor is fixed close by; before entering the atrium the penis-sheath becomes somewhat contracted; FREE OVIDUCT short; SPERMATHECA nearly spherical on a short duct, much expanded basally, and with no sign of the vaginal glands so marked in the preceding species; VAGINA long and thick and terminating in a somewhat spacious ATRIUM or vestibule, partially encircled by glandular tissue.

The ALIMENTARY CANAL is of the triodromous type; the ŒSOPHAGUS is long and greyish-white, darkening as it approaches the crop; SALIVARY GLANDS white basally thickened, and enveloping the Œsophagus; the CROP is a broad cylindrical vessel, of a dirty-brown colour, tinged with purple, and merging imperceptibly into the STOMACH, where there is an abrupt and stiff flexure; the INTESTINAL TUBE is of a dark grey, at first wide and capacious, but gradually diminishing in calibre after leaving the stomach; DIGESTIVE GLAND olive-yellow, hepatic arteries whitish, but the main vessel is almost transparent.

The RETRACTOR MUSCLES of *Hyalinia nitens*, as figured by Dr. Simroth, shows the PHARYNGEAL and TENTACULAR retractors as distinct and separate muscles, and does not show their origin from the COLUMELLAR muscle. The pharyngeal retractor is long and somewhat slender, slightly broadening, and becoming furcate for attachment to the buccal bulb; the tentacular muscles are markedly unequal in length, and divide quite low down, the branch to the lower tentacles being very long and slender, and the one to the ommatophore much stouter.

The MANDIBLE or jaw is of the usual oxygnathous¹ type, about a millimetre wide from side to side, strongly arcuate from front to back, the whole front surface being delicately and more or less vertically striate. The exact shape is somewhat variable; a specimen from Redcar showed a very broad jaw with a bluntly-rounded rostrum or beak and very fine vertical striation, while a Marske specimen of the sub-var. *helmsii* showed comparatively slender and elongate lateral limbs, with an acute projecting rostrum, and a greatly accentuated and protruding upper region.

The ODONTOPHORE is of the usual short oblong shape, measuring about three mill. long, and nearly a mill. wide, and bearing thirty-five transverse rows of teeth, slightly converging, each row constituted by a well-developed median tooth,

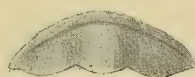


FIG. 107.—Mandible or jaw of *Hyalinia nitidula* Drap. $\times 20$. (Nr. Redcar, North-East Yorks., Mr. Baker Hudson).

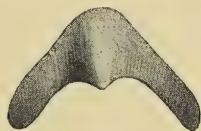


FIG. 108.—Mandible or jaw of *H. nitidula* sub-v. *helmsii* $\times 25$. (Marske, Yorks., Mr. B. Hudson).



FIG. 109.—Representative denticles from a transverse row of the odontophore of *H. nitidula* from Rhoon, near Rotterdam, $\times 200$ (after Schepmann). The formula is given as $\frac{3}{2}^8 + \frac{2}{2} + \frac{1}{2} + \frac{2}{2} + \frac{3}{2}$.



FIG. 110.—Representative denticles from a transverse row of the odontophore of *H. nitidula* $\times 150$. From a preparation by Mr. J. W. Neville.

with a largely developed mesocone and pointed ectocones, flanked by four well-developed and only slightly smaller lateral teeth, each bearing a large and well-developed mesocone and an ectocone, well marked, which, however, rapidly

diminishes in size and importance; the fifth and sixth teeth being really transitional, and leading to the thirty aculeate true marginals, which diminish very gradually in size as the margin of the odontophore is approached.

The formula of a specimen from Barmouth, collected by Mr. J. Hopkinson, was $\frac{3.0}{1} + \frac{5}{2} + \frac{1}{3} + \frac{5}{2} + \frac{3.0}{1} \times 35 = 2,485$.

Reproduction and Development.—The congress of this species has not yet been noted, but the eggs of the var. *nitens* are said by Moquin-Tandon and Gassies to be deposited amongst and beneath dead leaves from June to August and to be from thirty to fifty in number; they are very small and spherical, of a whitish colour, and rather glossy, with a somewhat cretaceous envelope which under a lens shows a number of minute spots.

Dr. Gain, who had this species in confinement, reported that eggs were deposited in the middle of September, and not buried but left scattered on the surface of the ground; they were about $1\frac{1}{2}$ mill. in diameter, with an opaque-white calcareous shell.

The hatching takes place in about fifteen days, and the growth is very slow, the shell not attaining full growth until the end of the following year, and according to Hazay the life-period of the var. *nitens* probably extends to two years.

Food and Habits.—Few notes have been made of the food of this species, although like its congeners it shows predilection for animal food, having been observed by Messrs. Boycott and Bowell feasting upon the dead body of an *Oniscus* at Longtown in Herefordshire; while a few individuals kept in confinement by Mr. L. E. Adams attacked and devoured several smaller individuals of their own species and an example of *Azeca tridens* confined with them, gnawing through the shell of the latter species to reach the inhabitant.

In captivity, Dr. Gain found this species to eagerly devour the fruit of the raspberry; and to partake freely of half-decayed thistle, foliage of onion, the roots of carrot and potato, and two species of *Russula*; less freely eaten were *Agaricus procerus*, the cornbine, houseleek, the leaves and roots of two kinds of turnips, while the Lesser Celandine was scarcely touched.

H. nitidula is generally considered to be a shy, timid, but somewhat irritable species, slow and sluggish in movement, carrying its shell at an angle of about 30° , and giving off an abundance of watery mucus.

A half-grown individual was timed and found to progress at the rate of a mile in forty-eight days and two hours.

Like the other allied species, it at times gives off an unmistakeable odour of garlic, but this power is a very variable one.

H. nitidula inhabits our woods and hedges, hiding under stones and amongst moss, nettles, dead and decaying leaves, rubbish heaps, etc., seeming to prefer moist and watery places.

Dumont and Mortillet have affirmed that in Savoy *H. nitidula* is restricted to the plains, ascending only to the vine zone, while *H. nitens* inhabits cold and moist forests on the mountain sides, but not ascending beyond the limit of trees, and has been collected at Lanslevillard, Savoy, at an altitude of about 5,000 feet; while *H. nitidula* is said by Pollonera to ascend only to 4,000 feet in Northern Italy.

Though not very sensitive to cold, it yet buries itself several inches deep in the soil during severe weather, emerging to the surface in the milder intervals. The pulsations of the heart are a little over eight per minute at 30° Fahr., rising to nine at 31° ; to thirteen at 41° , and attaining twenty-nine contractions when the temperature advanced to 52° .

Parasites and Enemies.—This species is not unfrequently infested by an *Acarus* apparently identical with the *Philodromus limacum*, which is a prevalent parasite on the slugs generally.

It would seem to be a favourite food of the stockdove, as Mr. C. E. Wright has verified that of 578 shells taken from the stomach of a single bird, fully 400 belonged to this species.

Geological History.—*Hyalinia nitidula* has been reported from the Pleistocene and Holocene beds in several localities in this country and from as low as the Upper Miocene in Germany.

UPPER MIOCENE.—Herr Clessin describes *Hyalina subnitens* as numerous in the Upper Miocene deposits at Mörsingen near Undorf, Bavaria.

LOWER PLIOCENE.—In France, M. Locard reports *H. nitens* from the Lower Pliocene beds at Hauterive in the department of the Drôme.

PLEISTOCENE.—In West Sussex, Mr. J. P. Johnson has found *H. nitidula* in the buried river-bed deposit on the foreshore at West Wittering.

In East Kent it is recorded from the freshwater marls at Charing and Maidstone by Prof. J. Morris. In West Kent it occurs at Stoneham's Pit, Crayford, and in the brick-earths at Erith; while Messrs. Kennard and Woodward record it from the Ightham fissure near Wrotham.

In South Essex it is recorded from the brick-earths at Grays by Mr. Searles V. Wood; while Dr. F. Corner has recently found specimens in Sam Green's pit, Ilford, and Mr. J. P. Johnson at the Uphall brickyard in the same district. In North Essex Prof. R. Tate has reported it from the freshwater marls of Copford and Clacton.

In East Suffolk it is recorded for Stutton by Prof. J. Morris.

In Cambridgeshire, Mrs. McKenny Hughes and the Rev. E. S. Dewick report it from the gravel pits about Barnwell Abbey and Grantchester.

In Yorkshire, Mr. T. Sheppard has found it at Bealsbeck near Market Weighton, in a very tough, dark, lacustrine marl of uncertain age, although remains of the lion, rhinoceros, elephant, etc., have been found therein.

In Germany, Sandberger reports *H. nitidula* as very rare in the Lower Pleistocene sands of Mosbach, Baden; from the tufa beds of Cannstadt and Burgtonna in Thuringia; and those of Weimar in Saxe-Weimar; also from the valley löess at Robschutz in Saxony. In the Mid-Pleistocene, *H. nitidula* and *H. nitens* have been found in the valley löess of Robschutz, and *H. nitens* rarely at Cannstadt. In the Upper Pleistocene, *H. nitidula* has occurred in tufa at Weimar, at Burgtonna, in the tufaceous beds of Pymont, and near Regensburg in Bavaria.

In Switzerland, according to Sandberger, Mousson detected *H. nitidula* in valley löess at St. Gall.

In France, M. Locard reports *H. nitens* as found fossilized in the Lower Pleistocene beds at Boisse in Savoy; Michaud and Paladilhe record *H. nitens* from the Mid-Pleistocene deposits at Hauterive in the Drôme, and from Celleneuve; while M. Locard records it from those at Moret, Seine-et-Marne. M. Locard also reports *H. nitidula* from the Upper Pleistocene deposits of the Somme Valley; and Von Ihering from diluvial tufa in French Switzerland.

HOLOCENE.—In West Cornwall, it was found in blown sand, Towan Head and Fistral bay cliffs, Newquay (Kennard & Warren, Geol. Mag., 1903, p. 21).

In Dorset, Mr. Clement Reid reports it from the tufaceous beds at Blashenwell near Corfe Castle.

In the Isle of Wight, Kennard and Warren record it from Totland Bay, in a recent tufaceous deposit, at the top of the cliffs, between Headon Hill and Widdick Chine.

In Hampshire, *H. nitidula* is recorded by Mr. J. T. Kemp as common in tufa at Southampton Dock, and near the waterworks in the Itchen Valley, and is also rarely found at Mottisfont in the Test Valley.

In East Kent it has been found by the Rev. R. Ashington Bullen in a deposit overlying the rubble-drift at Barton Court, Buckland, near Dover, and by Mr. J. W. Jackson in the brick-earth at Rochester. In West Kent, Mr. A. Santer Kennard discovered specimens at the base of a rain-wash deposit, from two to six feet thick, at Darenth, and has also been found in the sandy deposits exposed in excavating the reservoir for sewer outfall at Crossness.

In Surrey it was found by the Rev. R. A. Bullen at a depth of from eighteen inches to three feet in a Neolithic deposit at Colley Chalk-pit, near Reigate, and in alluvial loamy-clay on Thames bank at Kew by Mr. T. Belt.

In South Essex it has been found by Mr. F. C. J. Spurrell at Albert Docks (B. B. Woodward, Proc. Geol. Ass., 1890, p. 344); and in shelly-marl at East London Waterworks, Walthamstow, in which locality the authors describe these fossils as separable into a large form, attaining a diameter of 11 mill., and a smaller one of only 6·5 mill., "known on the continent under the name of *V. nitens* Mich." (Kennard and Woodward, Essex Nat., 1902, p. 18); peat-beds at Tilbury Docks, and post-glacial beds at Witham, Dr. S. P. Woodward (Kennard and Woodward, Essex Nat., 1897, pp. 92 and 108). In North Essex, Mr. Miller Christy found it common in black-earth, peat, and shell-marl at Chignal St. James; as well as in an alluvial deposit, at Duke's Farm, Roxwell; Mr. French has also detected it in the alluvial shell-marl at Felstead; and the Rev. A. J. Law in a drain section in "The Marsh," by Shalford Vicarage.

In Middlesex, in the old river bed, a mile west of Staines, on tow-path to Old Windsor, A. Loydell (Kennard and Woodward, Proc. Geol. Ass., 1906, p. 253); sandy deposit, Clapton, J. E. Greenhill; and from section, Charing Cross Railway, Blackfriars, by C. J. A. Meyer (B. B. Woodward, op. cit., pp. 342 and 352).

In East Gloucester it was found among the old soil of an Holocene gravel pit, Cleeve Hill, near Cheltenham (Hinton and Kennard, Proc. Cottesw. Nat. Field Club, 1904, p. 65).

In Scotland, Mr. T. Scott has found it, though not commonly, in the deposits close by Elie Railway Station in Fifeshire.

In Ireland, the Rev. A. H. Delap found examples in a marl deposit at Marlfield, near Clonmel in South Tipperary; and Mr. R. Standen records it from the earthy deposit at Dog's Bay, Galway West.

In France, M. Fagot reports that in the Haute Garonne *Zonites nitens* is very common in the deposit at Quartier de Caraman near Avignon, and *Z. subnitens* in the grey argillaceous beds at Hers.

In Belgium, *H. nitidula* is, according to M. Grégoire, very common in the Tourbe at Uccle lez-Bruxelles.

Variation.—The variation in the present species is not great, consisting chiefly in the greater or lesser dilatation of the last whorl and the occasional variation from the dull horn-coloured shell to a crystalline white or pearly aspect. Prof. Cockerell many years ago described a specimen from West Northdown, Isle of Thanet, which he referred to this species, that showed a broad, brown, spiral band, below the periphery, occupying the position of band 5 in the pentatæniæ formula, and which he afterwards termed var. *fasciata*.

The Marchioness Paulucci has also described an Italian var. *amiatae*, characterized as less convex, greenish, very glossy, last whorl less convex beneath, and lower margin of aperture less arched. Diam. 8–9 mill.; alt. 4 mill. The *H. nitens* var. *sicula* from Sicily, described as more finely striate and with a less dilated last whorl, would seem to be scarcely different from the typical *nitidula*.

Irish specimens would appear to almost constitute a geographical race, the bulk of the specimens being characterized externally by a noticeably paler and almost colourless shell.

VARIATIONS IN SHELL.

Var. *nitens* Michaud, Compl. à Drap., 1831, p. 45, pl. xv. f. 1–3.

Helix nitens Michaud, l.c.

Hyalina nitens var. *lundensis* Westerlund, Fauna Paläarkt. Binnen-Conch., 1886, p. 61.

SHELL with the last whorl much expanded laterally, umbilicus more open and excentric.

Original Description. — “*Helix nitens*, *H. testâ* orbiculato-depressâ, umbilicatâ, umbilico pervio, tenui, diaphanâ, nitidâ, minutissimè longitudinalitèr striatâ, sæpius corneo-fuscâ, interdum virente-albidâ, subtus pallidiore; anf. quaternis subplanis; aperturâ depressâ, obliquâ, expansâ; peristomate simplici, acuto. Hauteur 1½ ligne. Diam. y compris l’ouverture, 4 lignes. Diam. non compris l’ouverture, 3 lignes.” —MICAUD, Compl., 1831, p. 45.

The odontophore of *H. nitens* is, according to a Bavarian example examined by Heer Schepmann, practically the same as that of *H. nitidula*, but the median teeth are a trifle narrower and the longitudinal rows slightly less numerous.



FIG. 112.—Representative denticles from a transverse row of the odontophore of *Hyalina nitens* from Miesbach, Bavaria, $\times 200$ (after Schepmann). The formula is given as $2\frac{2}{3} + \frac{2}{3} + \frac{1}{3} + \frac{2}{3} + 2\frac{2}{3}$.

The sub-var. *lundensis* is described as rufous-horny in colour above, white below, closely and regularly striate, and scarcely dull; aperture elongately oval. Diam., 10 mill.; alt., 5 mill.

This form, which on the continent is very generally regarded as a distinct species, is said to be quite synonymous with the *Helix tenera* Faure Biguet, the *Helix splendidula* of Ziegler, and probably identical also with *Helix lucida* of Pulteney and Beck, the *Helix nitida* of Risso, and the *Helix sabaudiana* Bourg.

Michaud's original description of *Zonites nitens* gives the shell as dark horny, which Dr. Jeffreys alters by characterizing the shell as of a lighter colour than *Hyalina nitidula* and of a dull and waxy appearance. The differential character in this form is the greater amplitude of the last whorl, and I have, therefore, practically restricted the description to this feature.

In France this form inhabits moist places under moss and stones in woods in hilly or mountainous localities with a northern or western aspect. It is also recorded as living abundantly in the meadows and marshy lands margining the rivers.

In this country it is noted as found almost solely in boggy or marshy places, and is said by Dr. Jeffreys to be more widely distributed than the typical form.

On the west coast of Corsica, when living among the primitive rocks, the shell is said to be remarkably thin and transparent, and is probably the *Helix tenera* F.B., recorded as living in Saxony.

ENGLAND AND WALES.

Devon S.—Matford and Alphington (Marquand, J. of C., Oct. 1889, p. 138).

Isle of Wight—Carisbrooke, July 1869 (Lecomte, Bull. Mal. Soc. Belg., 1869).

Hants. N.—Rockingham Park, May 1896, Lionel E. Adams.

Surrey—Grove lane, Camberwell (D. Cooper, Flora Metropolitana, 1836, p. 122).

Boxhill and Headley lane (Loydell and Rowe, Moll. London District, 1883, p. 21).

Caterham, Aug. 1885! T. D. A. Cockerell. Croydon (C. Pannell, J. of Conch., July 1903, p. 332).

- Middlesex**—Hammersmith, J. Carter (D. Cooper, op. cit.).
Oxford—Under loose stones in a Portland sand quarry on Shotover Hill, Rev. S. Spencer Pearce (Conchologist, 1891, p. 20).
Bucks.—Olney, March 1893, Lionel E. Adams.
Cambridge—Grantham! Hugh Watson.
Gloucester W.—Under stones in moist places about Bristol (J. S. Miller, Ann. Philos., 1822, p. 379).
Hereford—Not uncommon (Boycott & Bowell, Contr. Fauna Heref., 1899, p. 27).
Worcester—Moor Green lane, Birmingham! W. Nelson.
Warwick—Marl-cliff near Bidford, Stratford-on-Avon! and Green lane, Small-heath! W. Nelson.
Salop—Garden, Oswestry, and Porthwyen Quarries, Oct. 1884! W. Whitwell.
Carmarthen—Golden Grove, Sept. 1904! Lady Lyons.
Merioneth—Craig Abermawr, Barmouth, Aug. 1884! J. Hopkinson.
Notts.—Stanton-on-the-Wolds, in woods, April 1878! C. T. Musson.
Derby—Roadsides, Clifton near Ashbourne, Norbury, and Winster, June 1889! Lionel E. Adams.
Lancashire S.—Near Prescott! and between Liverpool and Warrington, Sept. 1885, T. D. A. Cockerell.
Lancashire Mid—Woodwell, Silverdale, Sept. 1905, R. Standen.
York N.E.—Cobble Dump, Runswick Bay, June 1885! W. Denison Roebuck.
York S.W.—Roydhouse Wood, Huddersfield, April 1876, L. Peace.
York Mid W.—Shipley Glen bog and Nab Wood, Bingley, 1887, J. A. Hargreaves. Knaresborough and Birstwith (Fitzgerald, J. of Conch., Jan. 1889, p. 27). Stocks in Bolland, Aug. 1885! W. Denison Roebuck.

SCOTLAND.

- Lanark**—Falls of the Clyde near Lanark, Aug. 1886! Baker Hudson.
Haddington—Aberlady, 1888! W. Evans. Dunbar, 1888, Rev. Dr. McMurtrie.
Kincardine—Stonehaven, with type, Sept. 1886! W. Turner.
Aberdeen S.—The Links, Old Aberdeen, July 1886, C. B. Plowright.
Clyde Isles—Near aquarium, Rothesay, Bute, Nov. 1886! T. Scott.
Ebudes N.—Isle of Skye! Rev. Dr. Norman.
Ebudes S.—Oronsay! Rev. Dr. Norman.

IRELAND.

- Fermanagh**—Drumcu Bridge, Newtownbutler, Aug. 1889! J. G. Milne.
King's Co.—Under stones, Clonooney (T. Brown, Irish List, 1818, p. 525).
Tipperary S.—Near Clonmel, April 1888, Rev. A. H. Delap.
Waterford—Near Clonmel, April 1888, Rev. A. H. Delap.

GERMANY.

Prof. von Martens describes this form as dispersed throughout Middle and South Germany, and it has also been definitely recorded for Alsace, Upper Bavaria, Brunswick, Hanover, Hesse-Cassel, Holstein, Upper and Lower Franconia, Posen, Prussian Saxony, Saxony, Schleswig, Silesia, Upper Lusatia, and West Prussia.

FRANCE.

Found throughout the country, but most abundant in the east and south and in the hilly regions. Definite records have been published for the Ain, Aisne, Ariège, Aude, Auvergne, Calvados, Champagne Meridionale, Charente Inférieure, Côtes du Nord, Côte d'Or, Finistère, Gers, Gironde, Haute Garonne, Haute Loire, Hautes Pyrénées, Haute Savoie, Isère, Jura, Loire Inférieure, Lot, Lot et Garonne, Lozère, Manche, Maine-et-Loire, Meuse, Morbihan, Moselle, Oise, Pyrénées Orientales, Rhône, Saône et Loire, Savoy, Seine, Seine Inférieure, Somme, Var, Vendée, Vosges, and the Island of Corsica.

SWITZERLAND.

Recorded from the Cantons of Aargau, Berne, Glarus, Grisons, Lucerne, Neuchâtel, St. Gall, Schwyz, Solothurn, Ticino, Unterwalden, Uri, Valais, Vaud, and Zurich.

ITALY.

Recorded from Tuscany, Piedmont, Naples, in Campania, the Island of Sicily, and according to Prof. von Martens from the Island of Sardinia.

AUSTRO-HUNGARY.

Recorded from Hungary, Transylvania, Carinthia, Galicia, Croatia, Istria, Austria, Bohemia, Moravia, Styria, Tyrol, and Nemila in Central Bosnia.

SPAIN AND PORTUGAL.

Spain—Recorded from the Western Provinces and the Pyrenees of Catalonia by Graells; also reported from Aragon, Navarre, Old Castile, and Majorca.

Portugal—Reported by Prof. Hidalgo from Aveiro, Bussaco, Coimbra, and Geira in Beira, and Oporto in Minho.

SCANDINAVIA.

Norway—Langesund near Christiania (Westerlund, op. cit., 1897, p. 38).

Sweden—Common in the old botanic garden, Lund, plentiful in the beech-wood at Pehrsborg near Ronneby, while Luther reports it from Stockholm. Sub-var. *tundenstis* Westl., occurs about Lund, and on the Island of Gothland.

Denmark—Dr. Poulsen records it from the beech woods of Bornholm, and of Almindingen and Dyndalen in Zealand, while Herr Schlesch records it from Sveibæk in Jutland.

Var. *olearis* Westerlund, Nachr. Deutsch. Mal. Ges., 1883.

Hyalina nitens var. *olearis* Westerlund, l.c.

SHELL with regularly increasing whorls, with very fine spiral striation, last whorl scarcely dilated, but showing an open umbilicus; olive-brown, with a very greasy gloss above and scarcely white beneath; aperture slightly arcuate below. Diam., 9 mill.; alt., 5.5 mill.

SCANDINAVIA.

Sweden—Island of Gothland, Borgholm in the Isle of Oeland, and beech woods near Pehrsborg, Ronneby (Westerlund, l.c.).

Denmark—Fredericksdal near Copenhagen (Westerlund, l.c.). Very rare on the Island of Bornholm (Schlesch, Ann. Soc. Mal. Belg., 1907, p. 150).

Var. *subnitens* Bourguignat, Not. sur g. *Zonites*, 1869.

Zonites subnitens Bourguignat, l.c.

Zonites nitens var. *subnitens* Lepointe and Cardot, Moll. Montmedy, 1903, p. 6.

Hyalina nitens var. *ressmanni* Westerlund, Jahrb. Deutsch. Mal. Ges., 1883, p. 56.

SHELL distinguished from var. *nitens* by its more lofty spire and less dilated ultimate whorl.

The sub-var. *ressmanni* has the base anteriorly more tumid and the columellar margin strongly arcuate.



FIG. 113.—*H. nitidula* v. *subnitens* Bourguignat (after Baudon).

IRELAND.

Wicklow—Enniskerry, Aug. 1904! P. H. Grierson.

Kilkenny—Kilkenny, March 1902! P. H. Grierson.

Waterford—Cappoquin, Dec. 1902! P. H. Grierson.

FRANCE.

Recorded as *Zonites subnitens* from the departments of the Ain, Aisne, Alpes Maritimes, Côte d'Or, Jura, Oise, Seine et Marne, and Vendée. Lepointe and Cardot record it as *Zonites nitens* var. *subnitens* from the Ardennes.

AUSTRO-HUNGARY.

Hyalina nitens var. *ressmanni* is given by Clessin for Lossnitz in Carinthia.

SPAIN.

Recorded for Panticosa in Huesca, and the Valle del Salazar in Navarre, by Fagot; and for Bilbao in the Basque provinces by Westerlund.

Var. *hiulca* Jan ms., Albers, Helic., 1850, p. 66.

Hyalina hiulca Jan ms., Albers, op. cit.

Hyalina pudiosa Ziegl. in Mus. f. Clessin.

Hyalina nitens var. *major* Westerlund, Fauna Paläarct. Binnen-Conch., 1886, p. 64.

Hyalina nitens var. *szepe* Hazay, Clessin, Moll. Oester.-Ungarns., 1887, p. 75 and fig.

SHELL somewhat convex, of a larger size, and with five whorls, of a rufous colour above and whitish beneath, the last whorl greatly dilated. Diam. 13 mill.



FIG. 114.



FIG. 115.



FIG. 114.—*H. nitidula* var. *hiulca* Jan (after Moquin-Tandon).

FIG. 115.—*H. nitidula* sub-var. *szepe* Hazay (after Clessin).

The sub-v. *szepe* scarcely differs from var. *hiulca*, and has been described as possessing convex and rounded whorls, the last greatly dilated, mouth rounded oval. Diam. 12.5 mill.; alt. 6.5 mill.

The *H. hiulca* by a consensus of opinion is regarded as a larger and more fully developed form of the present species in its broad sense, although Heer Schepmann has pointed out that, in the Styrian specimen examined by him, the radula appears to show much larger teeth than either *nitidula* or *nitens*, and only possesses about fifty-five longitudinal rows, with but three laterals on each side of the central tooth.



FIG. 116.—Representative denticles from a transverse row of the odontophore of *Hyalinia hiulca* from Styria $\times 200$ (after Schepmann). The formula is given as $\frac{2}{1} + \frac{2}{2} + \frac{1}{3} + \frac{2}{4} + \frac{2}{5}$.

FRANCE.

The var. *hiulca* is recorded by Pascal as occurring in meadows at Bourg-la-Reine, Orsay, etc., in the department of the Seine; while Moquin-Tandon gives the Prats-de-Mollo, Pyrénées-Orientales, and Carcenac near Rodez in the Aveyron.

AUSTRO-HUNGARY.

The var. *hiulca* is found in Styria, Croatia and Carinthia. The sub-var. *szepe* is recorded from Kösze and Guns in Western Hungary (Clessin, op. cit., p. 75).

ITALY.

The var. *hiulca* is recorded by Tryon for Lombardy, and by Lessona and Pollonera for Gozzano on Lago d'Orta, and near Verbano at 400 to 1,000 ft. altitude in Piedmont.

Var. *alpina* Dumont and Mortillet, Moll. Savoie, 1857, p. 33.

Helix nitidula var. *alpina* Dumont and Mortillet, loc. cit.

Hyalinia nitens var. *dutaillyana* Mab., Rev. et Mag. Zool., 1868, p. 145.

Hyalinia nitens var. *minor* Westerlund, Faun. Binnen-Conch., 1886, p. 64.

SHELL smaller and more strongly striate than in type, mouth more circular and much deflected.

The sub-var. *dutaillyana* is smaller, with more impressed suture, and more oblique and narrowly oblong aperture.

The sub-var. *minor* is described as 6-7 mill. in diam. and 3 mill. in altitude, with a less dilated last whorl, and as more northern in its distribution.

GERMANY.

The sub-var. *minor* is recorded by Schmidt from Silesia and Aschersleben in Saxony. The sub-var. *dutaillyana* is recorded from Alsace by Morlet.

FRANCE.

In Haute Savoie the var. *alpina* is recorded from the Col de Bonhomme at an alt. of over 6,500 feet, also at Col de Vozaz, and at the Forest of Crozaz on the descent from the Forelaz, always on the high mountains (Dum. and Mort., op. cit.).

The sub-var. *dutaillyana* is stated by Westerlund to range over Southern and Eastern France.

SWITZERLAND.

The sub-var. *dutaillyana* is recorded for Switzerland by Dr. Westerlund.

AUSTRO-HUNGARY.

Sub-var. *minor*, Regensburg and Kapfelberg in Bavaria; also Palauer Berge near Brunn in Moravia (Clessin, l.c.).

RUSSIA.

Lindholm records *H. nitens* var. *minor* from the province of Kursk.

Var. **virens-albida** Michaud, Compl., 1831, p. 45.*Zonites nitens* var. *a virens-albida* Michaud, op. cit.*Helix helmii* Gilbertson MS., Alder, Mag. Zool. and Bot., 1837, p. 107.*Zonites nitens* var. *albinos* Moquin-Tandon, Hist. Moll. France, 1855, p. 84.*Helix nitens* var. *detrita* Dum. et Mort., Moll. Savoie, 1857, p. 33.*Zonites nitens* var. *opaca* Locard, Mal. Lyon, 1877, p. 17.*Helix nitens* var. *carthusiana* Locard, Ann. Soc. Agr. Lyons, 1879.

Original Description.—"Coq. . . . quelquefois d'un blanc teint d'une légère couche de vert (variété a)"—MICAUD, Compl., 1831, p. 15.

SHELL white, varying from a crystalline transparency often with a greenish or bluish tinge, to a more or less opaque pearly-white, usually with expanded ultimate whorl as in the var. *nitens*.

The var. **virens-albida** s.s. and the sub-var. **carthusiana** are of a crystalline greenish-white.

The sub-var. **helmii** is described by Alder as white in colour.

The sub-var. **opaca** is of a glossy and opaque milk-white, with the last whorl much expanded.

The sub-var. **albinos** of Moquin-Tandon is whitish or slightly azure.

The sub-var. **detrita** is small, excoriated in places, and of a nacreous tint.

The var. **helmii** as described by Westerlund (Fauna Europæa Molluscorum Extramarinorum, 1877, p. 23) is not strictly referable to the variety as understood in this country, being described as of an uniformly yellowish colour, and as living in England, Denmark, Germany, Switzerland, south of France, etc.

ENGLAND AND WALES.

Channel Isles—Sub-var. **helmii**, St. Saviour's, Guernsey (Tomlin and Marquand, Journ. of Conch., Jan. 1903, p. 286).

Somerset N.—Sub-var. **opaca**, Combe Dingle, near Bristol ! Miss F. M. Hele.

Sussex W.—Sub-var. **helmii**, Up Park and West Stoke, Sept. 1906 ! Rev. W. A. Shaw.

Kent E.—Sub-var. **helmii**, Minster near Ramsgate, Apr. 1883, T. D. A. Cockerell. Maidstone ! (Elgar and Lamb, Journ. of Conch., Jan. 1893, p. 154).

Kent W.—Sub-var. **helmii**, Orpington and Chislehurst, Aug. 1885 ! T. D. A. Cockerell. Brasted, Nov. 1904 ! F. H. Sikes. Sevenoaks, rare (Smith, Zool., 1854, p. 4333). Type and sub-vars. **helmii** and **opaca**, Bostal Wood, Mar. 1898 ! F. Taylor.

Surrey—Sub-v. **helmii**, Thames rejectamenta, Kew, Mar. 1884, T. D. A. Cockerell.

Essex N.—An almost diaphanous white variety is found in Little Stour Wood, Wrabness (Sheppard, Linn. Trans., 1825, p. 161).

Norfolk E.—Sub-var. **helmii**, Old Lakenham (A. Mayfield, J. of C., 1896, p. 185).

Cambridge—Sub-var. **helmii**, Cambridge ! Hugh Watson.

Notts.—Sub-var. **helmii**, Kingshaugh ! April 1885, and near Tuxford, W. Gain.

Derby—Sub-var. **helmii**, Miller's Dale, P. B. Mason.

Lancashire Mid—Sub-var. **helmii**, Preston ! (Alder Coll., Newcastle Museum). Near Fleetwood, Sept. 1891 ! L. E. Adams and C. Oldham. Woodwell, Silverdale, Sept. 1905 ! R. Standen. Bank Well, Silverdale, Nov. 1904 ! J. W. Jackson.

Cheshire—Sub-var. **helmii**, Compstall near Stockport, F. Taylor.

York N.E.—Specimens of sub-var. **helmii**, labelled "Scarborough" in the British Museum, Sept. 1886 ! By roadside near Marske, under stones, amongst nettles, Oct. 1883 ! Baker Hudson (see tail piece on page 80).

York S.W.—A sub-variety with a pinkish tinge at Newton near Wakefield (J. Hebden, Quart. Journ. of Conch., 1874, p. 5). Buck Wood, Thackley, with *H. alliaria* var. *viridula*, 1894, A. Hartley.

York Mid W.—Sub-var. **helmii**, near Seacroft Church, Sept. 1876 ! W. Nelson. Fairly common on a moist part of the railway bank at Apperley Bridge, Aug. 1894 ! A. Hartley.

SCOTLAND.

Main Argyle—Sub-var. **helmii**, Ardbhan Craigs near Oban, G. W. Chaster (Standen and Hardy, Journ. of Conch., Oct. 1893, p. 269).

IRELAND.

Antrim—Sub-var. **helmii**, on old building in wood, Ballycastle; also one with only the body whorl pure white, Sept. 1896 (Standen, Irish Nat., Jan. 1897, p. 4). Cave Hill, Jan. 1897, Portaleen Glen, July 1897, and Fair Head, Sept. 1907, R. Welch.

Down—Sub-var. **helmii**, Castlereagh Glen, 1898, R. Welch.

Donegal—Type and sub-var. **helmii**, under stones, Portsalon, and in burial ground at Fahan, May 1893 ! R. Standen.

Kilkenny—Sub-var. **helmii**, near Attenagh ! P. H. Grierson.

Leitrim—Sub-var. **helmii**, Mohill, July 1904 ! P. H. Grierson.

Galway W.—Type and sub-var. *helmii*, fairly common, Dernasliggan, April 1897 (R. Welch, Irish Nat., Nov. 1897, p. 304). Leenane, April 1897, R. Welch.

Clare—Sub-var. *helmii*, Lahinch, Nov. 1900 ! P. H. Grierson.

Tipperary S.—Sub-var. *helmii*, Grantstown, June 1885 ! R. Rimmer.

Waterford—Sub-var. *helmii*, Morgan's Glen, Clonmel, June 1886, A. H. Delap.

Cork S.—Sub-var. *helmii*, Ballyphehane near Cork, July 1907 ! R. Standen.

Kerry—Type and sub-var. *helmii*, Loo Bridge (R. Standen, Irish Nat., Sept. 1895, p. 219). Mr. Standen also records that on an island in Mid Cloonee Lake, the specimens are remarkably fragile, and almost as thin as a *Vitrina*; these are probably a form of the var. *tenera* F.B.

GERMANY.

Zonites nitens var. *albinos* is given for Alsace by Meyer, while a transparent and a white variety of *H. nitens* are said to be very rare at Patschkau, Silesia. The sub-var. *helmii* has been chronicled from Nordhausen, and also from Stuttgart in Wurttemberg.

FRANCE.

The sub-var. *helmii* has been recorded from the department of the Isère. The sub-var. *albinos* of Moq. from the Haute Garonne, Isère, and Savoy. The sub-var. *opaca* from the Rhône, while Locard has recorded as var. *albina*, very pale horn-coloured, almost white specimens found at an altitude of 1,200 feet near Colombier, in the Ain. The sub-var. *detrita* is found in the cold, humid, and lofty forests of Savoy.

SWITZERLAND.

Z. nitens sub-v. *albinos* recorded by M. Roffiaen from Iseltwald in Canton Berne, and Dr. Jeffreys records the sub-var. *helmii* from Lausanne in Canton Vaud.

AUSTRO-HUNGARY.

H. nitidula var. *albina* recorded by Reinhardt from Moravia.

SCANDINAVIA.

Denmark—*Hyalinia nitens* sub-var. *helmii*, Kongekilden in Zealand, and at Kanegaard in Bornholm (Westerlund, 1897, p. 38).

RUSSIA.

Recorded by Kaleniczenko for the province of Kharkov.

Var. **lucens** Pulteney, f. Westerlund, Faun. Eur. Moll. Extram., 1877, p. 24.

Helix lucens Pulteney, op. cit.

SHELL uniformly brown without the usual basal whiteness. The shells are thinner and smaller than usual, and according to Mr. A. G. Stubbs the animal appears very black as seen through the shell.

Dr. Westerlund describes this form as inhabiting Britain and the Jutland Peninsula.

Pembroke—Top of St. Catherine's Rock, Tenby ! A. G. Stubbs.

Monst. **sinistrorsum** Cockerell, Science Gossip, 1897, p. 262.

SHELL reversed.

FRANCE.

Zonites nitens enumerated as sinistral, from Agen, department of Lot et Garonne (Moquin-Tandon, 1855, vol. i., p. 321).

AUSTRO-HUNGARY.

A sinistral specimen of *H. nitens* var. *nitidula* recorded from Stanserjoch in the Tyrol by Gredler (Nachrbl. Deutsch. Mal. Ges., 1879, p. 107).

Geographical Distribution.—*Hyalinia nitidula* is found diffused over almost the whole of Europe, except the Balkan peninsula. *H. nitidula* is omitted by Luther in his account of the mollusca of Finland as a species not found in that country. Herr H. Schlesch has, however, sent undoubted specimens collected at Hango.

The reported occurrence in Western Canada is very puzzling, and is probably merely an accidental introduction.

In the British Isles its occurrence has been verified from nearly every county and vice-county into which the country is divided.



FIG. 117.—Geographical Distribution of *Hyalinia nitidula* (Drap.).

GERMANY.

Hyalinia nitidula appears to be diffused throughout the country, and has been recorded from Alsace, Baden, Bavaria, Brandenburg, Brunswick, Coburg, Franconia, Hanover, Hesse-Cassel, Hesse Darmstadt, Holstein, Lippe, Magdeburg, Nassau, Oldenburg, Osnabruck, Pomerania, Posen, Pymont, West Prussia, Rhenish Prussia, Reuss, Saxony, Silesia, Thuringia, Westphalia, and Wurtemberg. The var. *nitens* has in addition been found in Schleswig, Silesia, and Upper Lusatia, and the var. *minor* and sub-vars. of *helmii* are recorded from Silesia.

NETHERLANDS.

Belgium—Recorded by Colbeau and others from the provinces of Brabant, East Flanders, Hainault, Liège, Limburg, Luxembourg, and Namur.

Holland—Reported from Gelderland, South Holland, Limburg, and Zeeland.

FRANCE.

Found throughout the country, and in its typical form has been recorded from Aisne, Alpes Maritimes, Aquitaine, Ardennes, Ariège, Auvergne, Basses Pyrénées, Cantal, Côtes-du-Nord, Finistère, Gironde, Haute Garonne, Haute Loire, Hautes Pyrénées, Haute Savoie, Isère, Jura, Loire Inférieure, Lot et Garonne, Maine-et-Loire, Meuse, Morbihan, Moselle, Nièvre, Nord, Pyrénées Orientales, Rhône, Seine, Savoy, Somme, Var, Vienne, and Vosges. In addition, the var. *nitens* is found in Ain, Aube, Aude, Calvados, Champagne Meridionale, Charente Inférieure, Côte d'Or, Gers, Jura, Lot, Lozère, Manche, Oise, Saone et Loire, Seine et Marne, Seine Inférieure, Vendée, and the Island of Corsica. The var. *hiulca* is recorded for Aveyron by Moquin-Tandon.

ITALY.

Recorded from Lombardy, Tuscany, and Venezia; the var. *nitens* from Piedmont, Naples, and the Island of Sardinia; the var. *nitens* and sub-var. *sicula* from Sicily.

SWITZERLAND.

Herr Clessin denies the existence of this species in Switzerland and in alpine lands. It would appear, however, to be widely distributed, and has been noted as found in Appenzell, Berne, Geneva, Grisons, Lucerne, Neuchâtel, St. Gall, Schwyz, Unterwalden, Uri, and Vaud. The var. *nitens* has been recorded in addition from the cantons of Aargau, Glarus, Solothurn, Ticino, Valais and Zurich.

SPAIN AND PORTUGAL.

Spain—The var. *nitens* is reported from Catalonia, Aragon, Navarre, Old Castile, and the Island of Majorca. The var. *subnitens* from Navarre and the Basque Provinces.

Portugal—Morelet records the species as common at Cintra in Estremadura, and as occurring in the north in a strongly-coloured form. Signor Nobre reports it from Serra de Arrabida. The var. *nitens* is reported from Beira and Minho.

AUSTRO-HUNGARY.

Recorded as found in Austria, Bohemia, Carinthia, Croatia, Dalmatia, Galicia, Goritz, Hungary, Moravia, Transylvania, and the Tyrol. The var. *nitens* has been noted for Nemila in Central Bosnia. The var. *hiulca* in Styria.

SCANDINAVIA.

Norway—Apparently restricted to the southern part, and has been recorded from the districts of Trondhjem, Bergen, Christiansand and Christiania. The var. *nitens* is found in Christiania.

Sweden—Restricted to the south, and recorded for many places in the provinces of Skane, Blekinge, Smaland, and Svealand, as well as from the Islands of Oeland and Gothland. The var. *nitens* is confined to Stockholm and the extreme south of the province of Gothland.

Denmark—Very common everywhere throughout the country. Abundant at Alling in Jutland, and on the Islands of Zealand and Bornholm. The var. *nitens* is found at Sveibæk in Jutland, and in the beech woods of Zealand and Bornholm.

RUSSIA.

Apparently distributed throughout European Russia, being recorded from the provinces of Archangel, Courland, Crimea, Kharkov, Kiev, Kovno, Livland, Poland, St. Petersburg, Volhynia, and the territory of Kuban, in Caucasia; by Schlesch from South-west Finland (Hango!) and the Islands of Oesel and Dagö off the coast of Esthland. The sub-var. *minor* of the var. *nitens* is recorded from Kursk.

NEARCTIC REGION.

United States—Gardens, Oakland, California, G. H. Clapp, Nov. 1902.

Canada—Recorded from Fort Resolution, on Great Slave Lake, North-west Territory, by Kennicott (W. H. Dall, Moll. Alaska, 1905, p. 39).



FIG. 118.—Lane, Marske near Redcar, a habitat of *Hyalinia nitidula* sub-var. *helmii* (from a photograph by Mr. Baker Hudson).

Distribution of *Hyalinia nitidula* (Drap.)

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilts N.	48 Merioneth
8 Wilts S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid
21 Middlesex	HUMBER
22 Berks.	61 S.E. York
23 Oxford	62 N.E. York
24 Bucks.	63 S.W. York
ANGLIA	64 Mid W. York
25 Suffolk E.	65 N.W. York
26 Suffolk W.	TYNE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Humbs.	69 Westmorland
32 Northampton	and L. Lanes
SEVERN	70 Cumberland
33 Gloucester E.	71 Isle of Man
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easternness
76 Renfrew	97 W. HIGHLANDS
77 Lanark	97 Westernness
E. LOWLANDS	98 Main Argyle
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Pth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

Hyalinia pura (Alder).

- 1822 *Helix nitidosa* Férussac, Tabl. Syst., p. 45 (nomen nudum).
 1830 — *pura* Alder, Trans. Nat. Hist. Soc. Northumb., etc., vol. 1, p. 37.
 1830 — *nitidula* β Jeffreys, Trans. Linn. Soc., vol. xvi., p. 340.
 1833 — *nitidula* var. α Jeffreys, Trans. Linn. Soc., vol. xvi., p. 511.
 1837 — *lenticula* Held, Isis, p. 304.
 1840 — *alderi* Bean, ms. Gray's Turton's Manual, p. 171.
 1837 *Polita nitidosa* Held, Isis, p. 916.
 1837 *Helicella nitidosa* Beck, Ind. Moll., p. 6.
 1866 — *pura* Tate, Brit. Moll., p. 107, pl. 7, f. 55.
 1855 *Zonites (Aplostoma) purus* Moquin-Tandon, Hist. Moll., p. 87, pl. 9, ff. 22-25.
 1862 — *purus* Jeffreys, Brit. Conch., p. 164.
 1871 *Hyalina (Euhyalina) pura* Kobelt, Catal. Eur. Binnenconch., p. 5.
 1876 — *pura* Weinland, Weichth. Schwab. Alb., p. 37.
 1877 *Hyalinia pura* Westerlund, Faun. Eur. Moll. Extram., p. 25.
 1891 *Vitrea (Polita) pura* Smith, Journ. of Conch., vi., p. 339.



Joshua Alder

HISTORY.—*Hyalinia pura* (*pura*, clear), though apparently first discriminated and named by Férussac, was not described by that author, but in 1830 it was clearly described and the name *pura* applied to it by Mr. Joshua Alder, of Newcastle-on-Tyne, one of the most distinguished naturalists of his time, and with whom the species is here associated in respectful homage to his exceptional abilities and acumen.

According to Dr. Kobelt, it is the *H. pilatica* of Bourguignat, from the slopes of Mount Pilatus near Hergyswyl, Switzerland, and also *H. clara* of Held.

The *Helix viridula* of Menke, *Helix electrina* of Gould, *Helix vitrina* of Férussac, and *Helix nitidula* var. β of Draparnaud, have all been erroneously referred to *H. pura* by various authors.

Diagnosis.—This species resembles *Hyalinia nitidula* in form, but differs in its much smaller size, and different sculpture. From *H. radiatula* it may

be readily separated by its less depressed shape, wider umbilicus, and by the absence of the strong and regular radiate grooving characterizing the upper surface of that species. From *H. crystallina* it is also readily distinguished by its larger size, greater convexity, duller aspect, less closely coiled whorls, wider umbilicus, and reticulate sculpture.

When the shell contains the living animal, *Hyalinia pura* is strikingly distinguished by the opaque-white margin of the mantle from its ally *H. radiatula*, in which the pallial-edge is usually dark.

Original Description.—" *H. pura* mili. Shell depressed, rather shining, transparent, white, slightly striated or wrinkled; with four flattish whorls set diagonally; under side more shining than the upper, and without any appearance of opacity; umbilicus rather large; diameter rather less than $\frac{1}{10}$ ths or about $\frac{1}{4}$ th of an inch.

Animal white, with two black lines like the preceding [*H. crystallina*]; cloak white, speckled with black. A variety has the shell of a pale horn colour and the animal rather darker.

Under stones, decayed leaves, etc., in woods; not unfrequent.

This species somewhat resembles the preceding [*H. crystallina*], but is readily distinguished from it, by being larger, more convex, and less shining; the whorls less closely set, and the outer one larger in proportion to the rest. The umbilicus also is much larger. It has sometimes been taken for a variety of *H. nitidula*, but differs from that species in being scarcely one-third the size, of a different colour, and without any trace of opacity beneath.

White varieties of this tribe of shells undoubtedly sometimes occur, but these are generally mere sports of nature, which, like similar varieties in the higher classes of animals, are not perpetuated without the aid of art or domestication; such is not the case with this species, which preserves its characters unchanged even when living in the midst of its congeners."—J. ALDER, Trans. Nat. Hist. Soc. Northumb., 1830, vol. i., pt. 1, p. 37.

Description—The ANIMAL has a white and somewhat translucent BODY, sometimes tinged with yellowish, and covered with minute and close tuberculation; the HEAD and DORSUM are of a greyish shade; the black OMMATOPHOES are long and rather slender with slightly swollen tips, the broad RETRACTORS to which their dark colouring is due, are also distinctly visible through the dorsal skin as a pair of broad blackish lines on each side of the dorsum; the LOWER TENTACLES are comparatively elongate and also black, their retractors showing through the skin as a fainter black line along each side of the body and form the boundary of the darker colouration of the back; FOOT-SOLE short, narrow, pale, and indistinctly tripartite; MANTLE whitish, speckled with black.

The SHELL is convexly depressed above, and somewhat more convex beneath, rather dull, but semitransparent white, and beautifully but delicately sculptured by the intersecting spiral and transverse striæ, which form a beautiful reticulate pattern; SPIRE convexly raised; SUTURE puckerd by the folding of the incremental lines; WHORLS $3\frac{1}{2}$ –4, the last being somewhat dilated near the aperture, as in *H. nitidula*; MOUTH broadly crescentic; UMBILICUS open and somewhat wide, but disclosing all the internal spire, and without any basal opacity.

Diam., $3\frac{1}{2}$ mill. Alt., 2 mill. Average weight of an adult shell about $\frac{1}{8}$ th of a grain.

When containing the retracted animal, the shell appears of a fawn colour, darker towards the apex, but changing to white on the last whorl; mantle-margin as seen through the shell is opaque yellowish-white, marbled with blackish. Beneath, the basal surface is sometimes approximately but perceptibly divided into quadrants, distinguished by slightly differing colours, the pale section at the mouth of the shell is balanced by a nearly colourless section opposite, where the heart and renal organ are placed. Adjoining the commencement of the penultimate whorl is the dark fawn-coloured liver, while opposite there is the black marbled mantle.

The MANDIBLE or jaw is almost a millimetre in width from side to side, of the usual crescentic shape, with distinctly recurved ends; the central rostrum or beak is not very prominent, though well-marked and distinct; the lateral extremities are acutely pointed and turned upwards, the line of insertion within the tissues of the head is well-marked, and the chitinous prolongation which forms the roof of the buccal chamber is distinctly present.

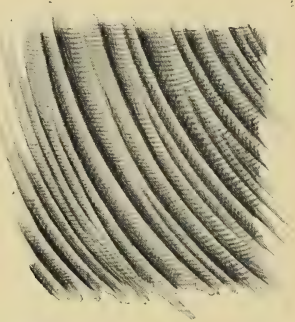


FIG. 120.—Surface sculpture of the penultimate whorl of *H. pura* var. *nitidosa* Fér., from Addingham, Yorks., Mr. F. Booth $\times 60$ (after microphoto. by Mr. J. W. Jackson)



FIG. 121.—Section through the shell of *Hyalinia pura*, showing the character of the whorls and umbilical cavity $\times 8$ (from a preparation by Mr. F. Rhodes).

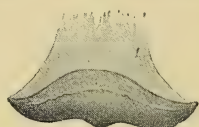


FIG. 122.—Mandible or jaw of *Hyalinia pura* $\times 30$ (Collon, Co. Louth, Mr. P. H. Grierson).

The REPRODUCTIVE ORGANS, according to Lehmann, exhibit a small, yellowish, and granular OVOTESTIS; the HERMAPHRODITE DUCT is sinuous and filiform; ALBUMEN GLAND linguiform, small, and yellowish; the OVIDUCT or matrix is distinctly sacculate; the PROSTATE or sperm-duct is ribbon-like and continued below as a very delicate, thread-like, and comparatively short VAS DEFERENS, which enters the penis-sheath terminally; PENIS-SHEATH comparatively long and cylindrical, the lower region is glandular and swollen, and the distal end is also thickened and distinctly clavate, but separated from the basal portion by a distinct constriction, apparently indicating the division of the true penial and epiphallial regions, the former organ having a lateral muscle; the slender terminal RETRACTOR MUSCLE is regarded by Lehmann as a flagellum; FREE OVIDUCT short and direct; SPERMATHECA ovaliform, borne on a stout and bottle-shaped stem, which is distinctly constricted at its junction with the vesicle.



FIG. 123.—Reproductive organs of *Hyalinia pura* Alder (greatly enlarged) after Lehmann.

The LINGUAL RIBBON resembles that of *H. nitidula* in the comparatively large number of the aculeate marginal teeth. It is of the usual shape, and according to Schepmann, the Bavarian specimen examined by him had a formula of $30 + 1 + 30$, while Rev. E. Wake Howell states that the formula of a Huntsham specimen is $2^2 + \frac{3}{1} + \frac{1}{1} + \frac{3}{1} + 2^2$, and Herr Clessin cites a specimen from the Island of Wollin as $3^0_1 + \frac{2}{1} + \frac{1}{1} + \frac{2}{1} + 3^0_1$. The median tooth exhibits the character of the sub-genus *Polita*, to which this species belongs, in being fully as large or larger than the adjacent laterals; it is tricuspidate, the middle cusp being especially strong and the side points well defined; the laterals are three in number, distinctly and strongly bifid, but also show a blunt and obsolete endocone. Heer Schepmann figures the fourth tooth as a bifid marginal and clearly transitional, while the true marginals apparently vary in number from twenty-one to thirty on each side, and decrease regularly in size to the outer margin of the membrane, where the outermost tooth is little more than a basal plate.

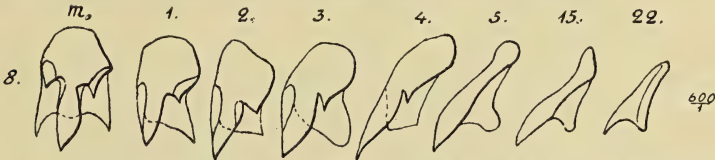


FIG. 124.—Representative denticles from half a transverse row of the teeth of *Hyalinia pura*, from Dinkelscherben, in Suabia $\times 600$, illustrating the median, the laterals, and some of the marginal teeth (after Schepmann). The formula is given as $30 + 1 + 30$.

Food and Habits.—*Hyalinia pura* is at times not very uncommon among moss, decaying leaves, etc., living together in little colonies, at the roots of trees in woods and hedgerows or even in pastures, generally preferring a moist situation, and even living at times in company with *H. nitida* beneath stones in boggy places and entirely submerged; although Mr. Petch remarks upon it as a species characteristic of the elevated lands in East Yorkshire. According to Westerlund, it is really a lowland species, and in Scandinavia is especially characteristic of the region of the beech, though found more or less sporadically throughout the oak region, to the northern limits of the maple, lime, ash, elm, etc. In the Tyrol it has been found on the margin of the Schwarzenstein Glacier, is sub-alpine in habit in the Sudetic Mountains, living where no trees or only *Pinus pumilio* grows. In Switzerland, it attains an altitude of 3,500 feet at Sierre, in the Canton of Valais, while Dr. Böttger affirms its existence at a altitude of 7,000 feet in the Alps.

It carries its shell almost horizontally, and is a very shy and timid though irritable animal, slow and lethargic in movement, and reluctant to crawl, differing thus from *H. radiatula*, which is bold, active, and

alert. Moquin-Tandon states that the heart beats with great rapidity in this species, but Mr. Watson, who has studied the circulation, has found that the pulsations average seventy times per minute when the temperature ranges from 60° to 65° Fahr.

According to Herr Clessin, *H. pura* is not so predatory and carnivorous as the larger species of the *Euhyalinia* group, but restricts itself more particularly, or indeed almost exclusively, to a vegetable diet.

Geological Distribution.—*Hyalinia pura* has not hitherto been found beneath the Pleistocene beds, either in this country or abroad.

PLEISTOCENE.—According to Prof. R. Tate, this species has been found in the fossil state in the Pleistocene freshwater marls of Copford, Clacton, etc., in North Essex.

In Germany, it is recorded by Herr Clessin as very rare in Pleistocene alluvium at Pürklgut, and as plentiful in tufa beds near Regensburg, Bavaria; and Prof. E. von Martens notes its occurrence in the diluvial beds of Thuringia.

In France, M. Locard records it from the Mid-Pleistocene deposits at Celle, in Seine-et-Marne, and also from those of Upper Pleistocene age in the Valley of the Somme.

HOLOCENE.—In West Kent, Mr. Kennard reports it from rainwash deposits of probably post-Roman age at Halling, Otford, and Greenhithe. In East Kent, the Rev. R. Ashington Bullen records it from the deposit overlying the Head or Rubble drift at Barton Court estate, on the north side of the Dour Valley, Buckland, near Dover.

In Surrey, the same observer discovered it at a depth of two feet in the Neolithic deposit at Colley chalk pit, near Reigate; and Mr. Kennard reports it from a rainwash of probably post-Roman age at Titsey.

In North Essex, Mr. Miller Christy records it as rare in the Post-Glacial black-earth and peat, but common in the overlying Shell-Marl at Chignal-St.-James, and as being also found in the Alluvium at Duke's Farm, Roxwell. Mr. French discovered it in the Alluvial Shell-Marl at Felstead, and the Rev. A. J. Shaw in the Alluvium of a drain-section in "The Marsh," near the Vicarage, Shalford.

In Ireland, Mr. R. Standen has discovered examples in the earthy deposit about a foot in depth at Dog's Bay, Galway West.

In France, Prof. von Ihering records it from the tufaceous deposits of French Switzerland, and M. Fagot has discovered *Zonites nitidosus* in the grey clays of Hers, in Haute Garonne.

Variation.—The known range of variation of this species is not great, as in addition to the white and horn-coloured forms which have alternately been regarded as the type form, only a more depressed variety has been described.

Although the species may perhaps be looked upon as essentially dimorphic, the horn-coloured and the white or colourless form being almost equally distributed and common, yet I have deemed it advisable to adhere to Mr. Alder's conception, and retain the white or colourless form as the true type of the species, and to therefore regard the horn-coloured specimens as a variety, differing in this from the opinion of the late Dr. Gwyn Jeffreys, who described the brownish form as the type and distinguished the white form as var. *margaritacea*.

Var. lenticula Held, Isis, 1837.

SHELL more depressed, smooth, aperture and last whorl not dilated nor rounded.

Oxford—Howe Wood, Watlington, June 1908! W. Denison Roebuck.

CONTINENTAL DISTRIBUTION.

Italy—Recorded by Paulucci for Sardinia.

Russia—Recorded from Kusary and Lenkoran in Baku; Suonetien, Mamudly, etc., in Kutais; Zalka, Mleti and Borschom in Tiflis; Helenendorf in Elizabetpol; and Radscha and Manglis in Armenia.

Sweden—Only in the province of Blekinge (Westerlund, Syn. Moll. 1897, p. 34).

Denmark—Occurs only on the Island of Møen according to Westerlund.



FIG. 125.—*H. pura* var. *lenticula* Held (after Paulucci).

Var. nitidosa Férussac.

Zonites purus Jeffreys, Brit. Conch., i., p. 161, 1862.

Zonites nitidosus Férussac, Tabl. Syst., 1821, no. 214.

SHELL of a clear fawn or horn colour.

Much confusion has arisen as to the precise identification of Férussac's *Helix nitidosus*, of which the author published neither figure nor description; but Mr. Alder, who examined the type specimens in Férussac's own cabinet, was emphatic as to their identity with the horn-coloured variety of *H. pura*.

Geographical Distribution.—This species, though seldom abundant, is widely but locally diffused throughout the British Isles; its occurrence having been verified for very many comital and vice-comital divisions. It would seem, however, to be more plentiful in the north.

In Ireland, the var. *nitidosa* is most prevalent over the central limestone areas or near them, while in the north-east the typical form is common in many little glens and other damp places.



FIG. 126.—Geographical Distribution of *Hyalinia pura* (Alder).

▨ Probable Range.

■ Recorded Distribution

Abroad, it has been recorded from Germany, France, Netherlands, Italy, Switzerland, Spain, Austro-Hungary, Scandinavia, and Russia, but many of the records are probably not reliable, as *H. pura* is a species that is not well understood.

GERMANY.

Dispersed throughout the country, and is on record for Alsace, Baden, Brandenburg, Bavaria, Bremen, Brunswick, Coburg, Franconia, Hanover, Hesse-Cassel, Holstein, Lippe-Detmold, Lusatia, Nassau, Oldenburg, Osnabruck, Pomerania, Posen, East and West Prussia, Suabia, Saxony, Silesia, Thuringia, Vogtland, Westphalia, and Wurtemberg.

NETHERLANDS.

Holland—Recorded by Jeffreys in 1881 as existing in the great wood between the Hague and Scheveningen in South Holland.

Belgium—Recorded from Roumont, Luxemburg, by Purves; and noted by Lecomte as rare in the Bois-de-Lessines, Hainault.

FRANCE.

H. pura, though said to be most prevalent in the northern departments and provinces, has been recorded from Aisne, Ariège, Aube, Aude, Brittany, Champagne Méridionale, Côte d'Or, Drôme, Haute Garonne, Haute Loire, Isère, Jura, Meuse, Morbihan, Nord, Normandy, Rhone, and Seine.

The horn-coloured form (var. *nitidosa*) has been especially recorded from the Ain, Alpes Maritimes, Ardennes, Hautes Pyrénées, Isère, Meuse, Oise, Pyrénées-Orientales, and Savoy.

SWITZERLAND.

Recorded from the cantons of Glarus, Grisons, Solothurn, Unterwalden, Valais and Vaud; while the var. *nitidosa* is known from Berne, Grisons, Schwyz, Unterwalden, Valais, and Vaud.

ITALY.

Said to be diffused over the mainland and the islands, being noted for Emilia, Piedmont, Rome, and the Islands of Sardinia and Sicily. The latter record is on the authority of Benoit, but the Marchese di Monterosato denies the occurrence of the true *H. pura* in Sicily.

AUSTRO-HUNGARY.

Recorded from Bohemia, Carniola, Galicia, Goritz, Moravia, and Tyrol. It has also been reported from Tatra Mountains in North Hungary, but this occurrence has not been confirmed, and is doubted by Herr Hazay. The var. *nitidosa* has been especially noted as found in Carinthia, Styria, and Tyrol.

SPAIN.

H. pura is cited by Chia from San Daniel near Gerona, in Catalonia; while Graells in 1846 recorded as *Helix nitidula* a species of *Hyalinia* from the Eastern Provinces of Spain, but this is ascribed to *H. pura* by Prof. J. G. Hidalgo of Madrid.

SCANDINAVIA.

Norway—Recorded by Miss Esmark from Romsdalen in Trondhjem; Manger in Bergen; Eker and Langesund in Christiansand, and Christiania.

Sweden—Found sporadically over Middle and Southern Sweden as far north as Dalarne. The provinces of Skane, Blekinge, Smaland, Bohuslän, Ostergötland, Westergötland, Orebro, and the Island of Gothland are especially recorded as inhabited by this species.

Denmark—According to Mr. Henrik Sell, it is quite common on Zealand at Slagelse, Helsingor, and other localities in the north of the island. On Funen it has been found at Nyborg, Kongebro Skov, and other places. On the peninsula of Jutland, it occurs at Veile in Ribe, Silkeborg in Aarhuus, and at Viborg.

RUSSIA.

Probably diffused over the southern and western region, and has been reported as *H. pura* or *H. nitidosa* from Crimea, Caucasus, Kovno, Poland, St. Petersburg, Volhynia, the province of Abo in Finland, and Revel in Esthland, also from the Black Sea to the shores of the Caspian in Transcaucasia.

SIBERIA.

H. pura is recorded by Middendorf from the Stanovoi Mountains, but Westerlund denies its occurrence in Siberia and affirms the specimens to be *H. hammonis* of Ström. He equally dissents from the identification by Schrenk as *H. pura* of the shells found by Maack in Amourland.

Distribution of *Hyalinia pura* (Alder)

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles		SOUTH WALES	
PENINSULA	41	Glamorgan	
1 Cornwall W.	42	Brecon	
2 Cornwall E.	43	Radnor	
3 Devon S.	44	Carmarthen	
4 Devon N.	45	Pembroke	
5 Somerset S.	46	Cardigan	
6 Somerset N.		NORTH WALES	
CHANNEL	47	Montgomery	
7 Wilts N.	48	Merioneth	
8 Wilts S.	49	Carnarvon	
9 Dorset	50	Denbigh	
10 Isle of Wight	51	Flint	
11 Hants S.	52	Anglesey	
12 Hants N.		TRENT	
13 Sussex W.	53	Lincoln S.	
14 Sussex E.	54	Lincoln N.	
THAMES	55	Leic. & Rutld.	
15 Kent E.	56	Notts.	
16 Kent W.	57	Derby	
17 Surrey		MERSEY	
18 Essex S.	58	Cheshire	
19 Essex N.	59	Lancashire S.	
20 Herts.	60	Lancashire Mid	
21 Middlesex		HUMBER	
22 Berks.	61	S.E. York	
23 Oxford	62	N.E. York	
24 Bucks.	63	S.W. York	
ANGLIA	64	Mid W. York	
25 Suffolk E.	65	N.W. York	
26 Suffolk W.		TYNE	
27 Norfolk E.	66	Durham	
28 Norfolk W.	67	Northumb. S.	
29 Cambridge	68	Cheviotland	
30 Bedford		LAKES	
31 Hunts.	69	Westmorland	
32 Northampton		and L. Lanes	
SEVERN	70	Cumberland	
33 Gloucester E.	71	Isle of Man	
34 Gloucester W.			
35 Monmouth			
36 Hereford			
37 Worcester			
38 Warwick			
39 Stafford			
40 Salop			

SCOTLAND.

W. LOWLANDS		E. HIGHLANDS	
72 Dumfries		93 Aberdeen N.	
73 Kirkcudbright		94 Banff	
74 Wigton		95 Elgin	
75 Ayr		96 Easternness	
76 Kenfrew		W. HIGHLANDS	
77 Lanark		97 Westernness	
E. LOWLANDS		98 Main Argyle	
78 Peebles		99 Dumbarton	
79 Selkirk		100 Clyde Isles	
80 Roxburgh		101 Canire	
81 Berwick		102 Ebudes S.	
82 Haddington		103 Ebudes Mid	
83 Edinburgh		104 Ebudes N.	
84 Linlithgow		N. HIGHLANDS	
E. HIGHLANDS		105 Ross W.	
85 Fife & Kinross		106 Ross E.	
86 Stirling		107 Sutherland E.	
87 Pth. S. & C'kn.		108 Sutherland W.	
88 Mid Perth		109 Caithness	
89 Perth N.		NORTH ISLES	
90 Forfar		110 Hebrides	
91 Kincardine		111 Orkneys	
92 Aberdeen S.		112 Shetlands	

IRELAND.

ULSTER		LEINSTER	
113 Derry		122 Louth	
114 Antrim		123 Meath	
115 Down		124 Dublin	
116 Armagh		125 Kildare	
117 Monaghan		126 Wicklow	
118 Tyrone		127 Wexford	
119 Donegal		128 Carlow	
120 Fermanagh		129 Kilkenny	
121 Cavan		130 Queen's Co.	
		131 King's Co.	
		132 Westmeath	
		133 Longford	
		CONNAUGHT	
		134 Roscommon	
		135 Leitrim	
		136 Sligo	
		137 Mayo E.	
		138 Mayo W.	
		139 Galway W.	
		140 Galway E.	
		MUNSTER	
		141 Clare	
		142 Limerick	
		143 Tipperary N.	
		144 Tipperary S.	
		145 Waterford	
		146 Cork N.	
		147 Cork S.	
		148 Kerry	

Probable Range.



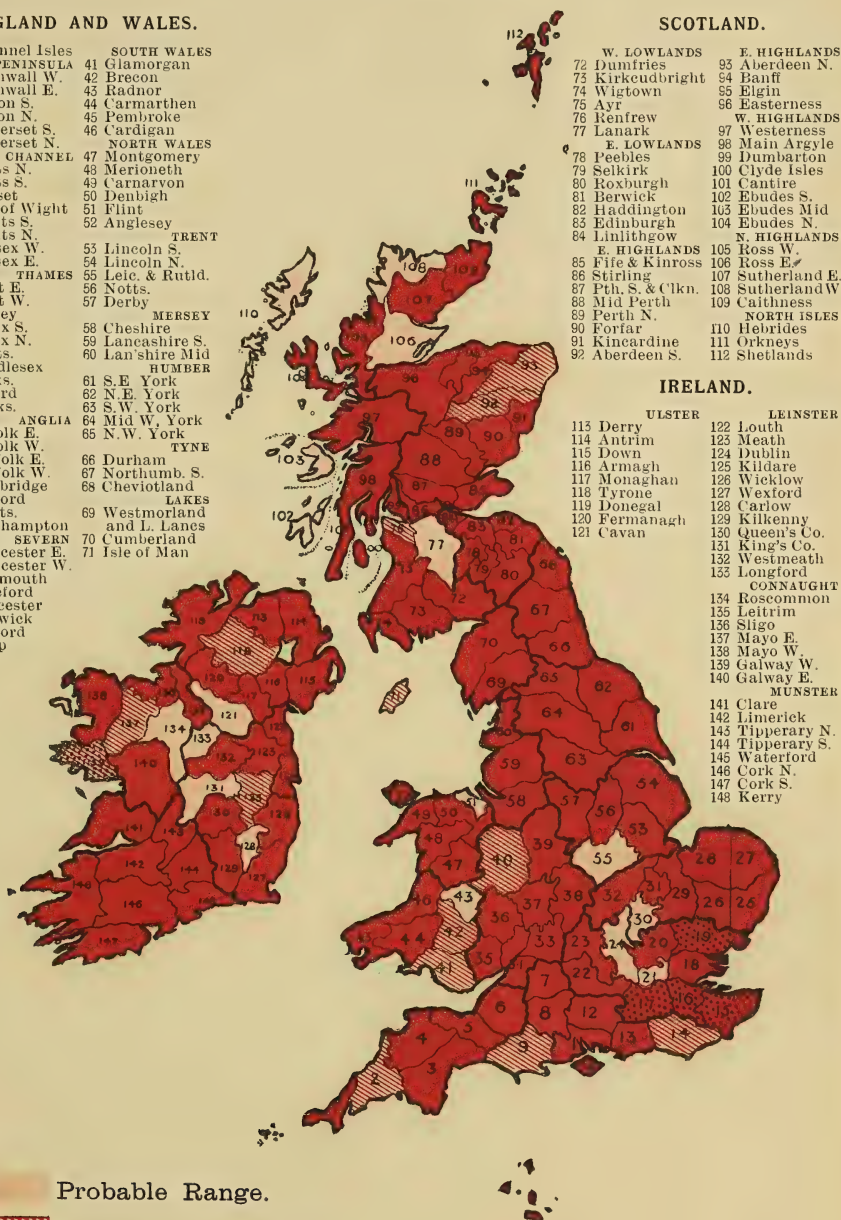
Recorded Distribution.



Distribution verified by the Author.

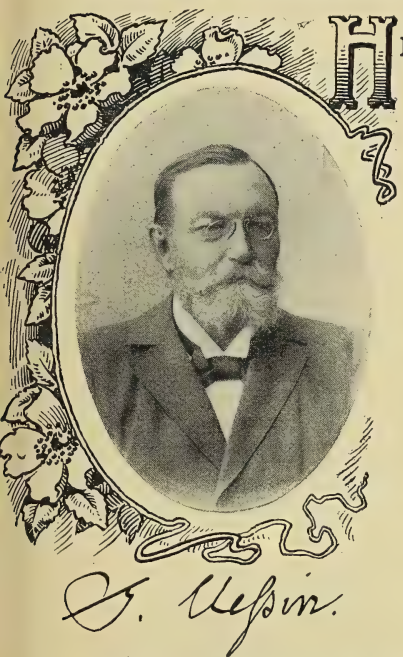


Geological Distribution.



Hyalinia radiatula (Alder).

- 1805 *Helix nitidula* var. β Drap., Hist. Moll. France, p. 117, pl. viii., ff. 21, 22.
 1821 — *striatula* Gray, Medical Repos., xv., p. 239 (without characters).
 1830 — *radiatula* Alder, Trns. Nat. Hist. Soc. North. Durh., etc., i., p. 38, no. 30.
 1830 — *viridula* Menke, Syn. ed. ii., p. 127.
 1841 — *electrina* Gould, Invert. Mass., p. 183, f. 111.
 1841 — *janus* Adams MSS. (olim) Shells Verm., Amer. Journ. Sci., xl., p. 273.
 1848 — *pura* var. β Pfeiffer, Monog. Helic., i., p. 96.
 1853 — *petronella* Charp. in Pfeiffer, Mon. Hel. Viv., iii., p. 95.
 1840 *Zonites radiatulus* Gray, Turton's Man., p. 173, pl. xii., f. 137.
 1855 — (*Aplostoma*) *striatula* Moq.-Tand., Hist. Moll., ii., p. 86, pl. ix., ff. 19-21.
 1864 — *dumontianus* Bourguignat, Mal. Aix les Bains, p. 26.
 1858 *Helicella radiatula* Bellars, Ill. Cat. Br. L. & F.W. Shells, p. 16, pl. 2, f. 39.
 1876 *Hyalina striatula* Weinl., Weichth. Schwab. Alb., p. 38.
 1884 — *pellucida* Lehnert, Science Record, June 16, 1884, p. 172.
 1891 *Vitrea (Polita) radiatula* Smith, Journ. of Conch., vi., p. 339.
 1897 *Hyalinia hammonis* Westerlund, Syn. Moll. Extram., p. 34.



HISTORY.—*Hyalinia radiatula* (*radiatula*, finely or delicately radiate) though first noticed and named by Dr. Gray in 1821, was not described or figured by him, so that Alder's name published in 1830, which was accompanied by a full description, takes precedence.

Ström, the Norwegian, in 1765, described and figured in the "Trondj. Selsk. Skrift," iii., p. 435, pl. 6, f. 16, a *Hyalinia* under the name of *hammonis*, which is regarded by many as the same as our species; but this opinion is by no means universally held, as Dr. L. Pfeiffer in his great work "Monog. Helic. Vivent." regarded Ström's species as synonymous with *Hyalinia nitida*, and subsequently as identical with *H. pura*, while Binney and Bland considered it more properly referable to *H. fulva*, and Tryon and later Dr. Dall consider its identification with *H. radiatula* as very doubtful.

After a careful examination and study of Ström's original description and figure (see p. 88) I have decided to retain the well-known name *radiatula*, a name upon the precise identification of which there can be no dispute.

Considerable difference of opinion also exists as to the precise relationship between *H. radiatula* Alder, *H. viridula* Menke, *H. petronella* Charp., and *H. electrina* Gould, whether they should be regarded as really synonymous or as closely allied species, but as no structural differences have hitherto been demonstrated, the interests of the study will be best served by regarding them as geographical races of the typical *radiatula*.

The present species is here dedicated to the well-known conchologist, Herr Stephan Clessin, of Ochsenfurt, Bavaria, for some time editor of "Malakozoologischer Blätter," and author of numerous valued publications, who has paid some attention to the lingual dentition of the present species.

Diagnosis.—*H. radiatula* may be distinguished from *H. pura* its closest ally, by its much more glossy aspect, smaller umbilicus, and the very distinct and regular radial striation. From the young of *Z. nitidus* and *Z. excavatus* it may be distinguished by its size and number of whorls and by the character of the striae and umbilicus.

Original Description.—" *H. radiatula* mihi. Shell depressed, horn coloured, rather shining, transparent, regularly striated; with $3\frac{1}{2}$ to 4 whorls, flattened at their junction with the inner ones, over which the striae appear continuous and strongly marked, giving the shell a radiated appearance under a magnifier; the outer whorl rather large in proportion to the rest; underside smooth without any whiteness; umbilicus moderately large; diameter $1\frac{1}{2}$ tenth of an inch.

Animal black.

In wet moss, not uncommon.

This species may be distinguished from the young of the foregoing [*H. nitidula*] to which it bears some resemblance by the regular and more distinct striae, and particularly by the flatness of the whorls at their junctions. The same characters serve to divide it from the young of the two following species, *H. nitidula* and *H. excavata*."—J. ALDER, Trans. N.H. Soc. N.D. & N., vol. i., pt. 1, p. 38, 1830.

Original Description.—"66. *Helix (Hammonis)* testa umbilicata planiuscula anfractibus quatuor, apertura subrotundo-lunata.

In this way I distinguish a small land shell which is found here [Sondmor] under stones and rotten wood in fields. The shell resembles in shape the so-called '*Cornua hammonis*,' but is somewhat flat, and exhibits 4 whorls on the upper side, of which the first almost equals the rest of the shell. On the under-side there is only 1 whorl, with a round hole in the middle. The aperture is similar to the preceding [*Vitrina*] but proportionately less and more encroached upon by the penultimate whorl. It is of a horn-colour, but usually somewhat yellow near the apertural margin. The shell is very fragile and translucent, and the animal within is a blue-black snail with 4 horns."—HANS STROM, Trondj. Selsk. Skrift., 1765, iii., p. 435-6, pl. vi., f. 16.

Description.—ANIMAL with a slender BODY, blunt anteriorly and pointed behind; HEAD and DORSUM bluish-black, with widely-set dorsal grooves, and with flat and indistinct tuberculation; sides and hinder part of body grey, slate-coloured, or almost colourless, with coarse isolated tubercles on the TAIL; MANTLE grey; OMMATOPHORES long and somewhat bulbous at end; the BLACK RETRACTORS visible through the tissues; LOWER TENTACLES short, only about $\frac{1}{4}$ th the length of the ommatophores; FOOT-SOLE with distinct pedal furrows, trifasciate beneath, the median area pale grey or whitish, and the outer zones perceptibly darker.

SHELL only slightly convex above and below, remarkably glossy, thin and somewhat translucent, of a horn colour of variable intensity in different individuals



FIG. 128. — *Helix hammonis* Str., Trondj. Selsk. Skrift., pl. vi. f. 16.



FIG. 129.—Outlines of the basal and frontal aspects of *Hyalinia radiatula* (Alder) from Murlough Bay, co. Antrim $\times 5$.

(After camera lucida drawings by Mr. G. H. Clapp).



FIG. 130. — Surface sculpture of the ante-penultimate whorl of *Hyalinia radiatula* var. *viridula* (Menke), from Shipley glen, Yorks., Mr. F. Booth, $\times 70$.

(After micro-photo. by Mr. J. W. Jackson).

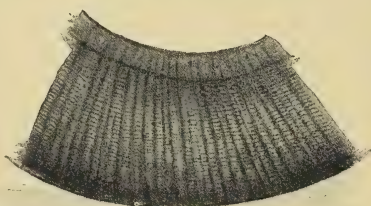


FIG. 130.

and from different localities, slightly paler below, regularly and beautifully sculptured across the whorls from apex to periphery by strong, curved, and closely-set radiating striae, which are continued more faintly to the umbilical region; very fine and delicate spiral striation only perceptible under a lens is also present on the upper surface; SPIRE slightly exserted; SUTURE shallow; WHORLS about $4\frac{1}{2}$, convex, the last whorl somewhat laterally dilated; MOUTH somewhat oval, sometimes thickened by a slight marginal rib; UMBILICUS narrow but deep, disclosing all the internal spire.

Diam., 4 mill. ; alt., almost 2 mill.

The shell in crawling is borne elevated on the left rear side of the body, and during progression sways perceptibly from side to side.

When containing the retracted animal, the shell shows the reddish-brown digestive gland with its delicate whitish reticulations, the colour gradually paling until the dark collar of the mantle is reached.

Beneath, the brownish digestive gland with indistinct black marblings fills the major part of the shell, and it becomes increasingly blackish towards the periphery and beyond the pale renal organ.

When crawling, the shell beneath shows only the dark mantle collar and three digitiform, fawn-coloured lobules of the digestive gland, the remaining space being fairly clear.

The ALIMENTARY ORGANS are described by Dr. Lehmann as showing a short ŒSOPHAGUS, surrounded by the ample and yellowish SALIVARY GLANDS ; the CROP or stomach as elongately fusiform and bent in a crescentic shape, its walls showing strong, transverse musculature ; and the INTESTINAL TRACT as long and convoluted.

The REPRODUCTIVE ORGANS exhibit the OVOTESTIS with a moderately long and convolute HERMAPHRODITE DUCT ; ALBUMEN GLAND large, linguiform, finely granular and of a milky-white color ; SPERM-DUCT narrow and ribbon-like, continuing as a moderately long and sinuous VAS DEFERENS, which enters the penis sheath at its distal end ; PENIS SHEATH short and pyriform, with a short terminal retractor affixed close by the point of entry of the vas deferens ; OVIDUCT or matrix very sacculate, constricted above at its junction with the albumen gland, greatly amplified below ; FREE OVIDUCT moderately long, VAGINA short and wide, beneath the yellowish-brown cloak ; SPERMATHECA claviform and transparent, the vesicle exceeding a mill. in length, supported by a very slender stem.



FIG. 131.—Reproductive organs of *H. pura* $\times 8$ (after Lehmann).

The JAW of a *Hyalinia radiatula* from Swarraton, in Hants., is of the usual horny-brown colour, very deep, strongly arched, with unusually broad lateral limbs, terminating in an acute outer point ; the median rostrum or beak is somewhat narrow, but well-marked and prominent, and the line of insertion into the tissues is clearly perceptible.

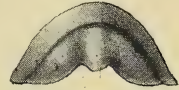


FIG. 132.—Mandible or jaw of *H. radiatula* Alder $\times 30$ (Swarraton, Hants., Rev. W. L. W. Eyre).

The LINGUAL RIBBON of a Swarraton specimen is of the usual elongate shape, about a millimetre in length, and about a quarter of a millimetre in width, and composed of about seventy-five partly-curved transverse rows of teeth. Each row is composed of a large distinctly tricuspid median tooth on a broad sub-triangular base, furnished with a long and powerful mesocone and a distinct ectocone on each side, all with well-defined cutting points. The admedian or lateral teeth are

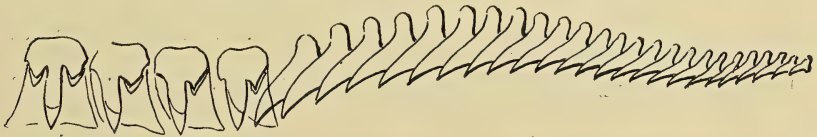


FIG. 133.—Half a transverse row of the teeth of *Hyalinia radiatula* $\times 600$, from Swarraton, North Hants., Rev. W. L. W. Eyre.

The formula of a Swarraton specimen is

$$\frac{2.5}{1} + \frac{3}{2} + \frac{1}{3} + \frac{3}{2} + \frac{2.5}{1} \times 75 = 2,875.$$

three in number, and all are practically bifid, each presenting a well-developed mesocone and ectocone. The marginals are about twenty-five in number, all strictly aculeate in shape, without any transition teeth linking them with the laterals, and decreasing rapidly in size as the outer margin is approached.

The TEETH of *H. hammonis* are described by Dr. Lehmann as consisting of eighty transverse rows, each composed of a mid-area of seven to nine teeth, and a marginal area on each side with about twenty-four aculeate teeth. The mid-tooth is tricuspid, and larger than the adjacent laterals, and which are also described as tricuspid, while the marginals are long and thorn-like upon an acutely triangular base. The formula is given by Schepmann as $\frac{2}{1}^2 + \frac{3}{2} + \frac{1}{1} + \frac{3}{2} + \frac{2}{1}^2$



FIG. 134.—Representative denticles from a transverse row of the teeth of *Hyalinia hammonis* from Rhooon, Holland $\times 600$ (after Schepmann).

Habits and Habitat.—*H. radiatula* and its allied forms or varieties are alike in being strictly geophilous, and in preferring a moist habitat, whether it be amongst the moss and grass in damp pastures or beneath stones and decaying leaves in woods, ditches, and damp places generally, though it is occasionally recorded as found in dry situations.

During the day they ensconce themselves beneath the lowest layer of moist decaying leaves, usually indeed on the wet ground or attached to the underside of the lowermost leaves.

In winter they retire deeply within the dense tufts of grass on the outer edge of the boggy land, secreting a very thin and vitreous epiphragm, but on favourable occasions becoming active, even as early as January.

It is a very bold and active species, continually exerting and retracting its tentacles and often crawling actively about with tentacles quite withdrawn within the body.

In its varietal form, *petronella*, it ascends to considerable heights, and in Piedmont, according to Signor Pollonera, inhabits the mountains from 5,000 to over 9,000 feet altitude, being replaced on the lower slopes by the type form, which does not ascend beyond 5,000 feet; it also becomes more generally prevalent towards the north and towards the confines of its distributional area, extending in the Scandinavian peninsula beyond the oak region, up to that of the willows and pines and far into the region of the birch.

The HEART is, as in other species, stimulated to increased activity by warmth and retarded by cold. The pulsations of a specimen at 27° Fahr. were observed to be barely nine per minute; at 54° they had risen to forty-four; at 62° the contractions were fifty-two per minute; while at 65° they attained a rapidity of fifty-five in the same space of time.

Geological Distribution.—*Hyalinia radiatula*, though so ancient and widely distributed, has not as yet been found beneath the Lower Pliocene deposits on the continent, nor lower than the Pleistocene in this country and America.

LOWER PLIOCENE.—Recorded by M. Locard from Hauterive in the department of the Drôme, France.

PLEISTOCENE.—In South Wilts., it is reported by Mr. Kennard from river deposits at Fisherton, near Salisbury.

In East Kent, it is recorded from the freshwater marls of Maidstone and Charing by Prof. Morris. In West Kent, it is listed by Mr. Abbott amongst the species found in the Ightham fissure near Wrotham, recorded for the Pleistocene beds of Crayford and Erith by Mr. A. Tylor, by Mr. B. B. Woodward for Stoneham's Pit, Crayford, and by Mr. Kennard from the sandy-gravel river deposit so marvellously rich in mollusca at Swanscomb.

In South Essex, it is recorded for Grays by Mr. S. V. Wood, and Mr. J. P. Johnson notes it as found by Mr. G. White in the Palæolithic deposit at Uphall Brickyard, Ilford. In North Essex, it is noted from the fresh-water marls of Copford, Clacton, etc., by Prof. Ralph Tate, and by Mr. French from shelly-marl beneath eighteen inches of Boulder Clay, at Bushy Leys, Felstead.

In Middlesex, it is reported from the river deposits at Clapton by Mr. Kennard.

In Cambridge, Mrs. McKenny Hughes records its presence in the gravels at Barnwell Abbey and Grantchester.

In Germany, *H. hammonis* is uncommon in the Lower Pleistocene sands of Mosbach in Baden, and in tufa at Canustadt and Burgtonna in Thuringia, but rare in the Mid-Pleistocene beds at Cannstadt. It has been found abundantly by Herr Clessin in the alluvium at Pürklgut, and in company with *H. petronella* in the tufa deposits near Regensburg, Bavaria, while Mr. Kennard reports its occurrence in Pleistocene beds at Batten-dorf near Rossleben in Prussian Saxony, and it has been found in the lower layers of the loess in the Rheingau, Nassau, by Dr. Koch.

In France, it is recorded for the Upper Pleistocene beds of the Somme, and of Bas Boulonnais by M. Locard.

In the United States, Mr. Bryant Walker records *H. radiatula* from the soil beneath the remains of a mastodon in Randolph co., Indiana, and as *Vitrea hammonis* under similar conditions in Berrien co., Michigan.

HOLOCENE.—In North Wilts., Mr. Kennard reports its occurrence in a rainwash of uncertain age at Little Bedwyn.

In the Isle of Wight, Messrs. Kennard and Warren record it from south-west of Widdick Chine, Totlands Bay, in a recent tufaceous deposit, overlaying the *Potamomya* sands, and Mr. Kennard reports it also from a Neolithic rainwash on St. Catherine's Down.

In Hampshire, it is recorded by Mr. J. T. Kemp as common in the tufa, Netley Shoal, and at Mottisfont in the Test Valley, and as occurring rarely in the tufa at Southampton Docks.

In West Kent, it has been found in a rainwash, probably of the Bronze age, at Exedown, near Wrotham.

In Surrey, it is reported by Mr. Kennard from a "pipe" in the chalk at Walton Heath.

In South Essex, it is recorded by Mr. Woodward as found in a shell-marl section at the East London Waterworks, Walthamstow. In North Essex, Mr. Miller Christy records it as common in the shell-marl, and as rare in the black-earth and peat of the post-glacial deposit at Chignal St. James, and as also found in an alluvial deposit at Duke's Farm, Roxwell; the Rev. A. J. Law has also detected it in the alluvium of a drain section in the "Marsh" near Shalford Vicarage, and Mr. S. P. Woodward in a post-glacial deposit at Witham.

In Middlesex, Mr. A. Loydell has found it in the old river bed, a mile west of Staines, on the tow-path to Old Windsor, and Mr. Kennard reports it from a post-Roman Alluvial deposit of the Colne at Uxbridge.

In Berkshire, it is reported from Neolithic beds, Newbury, by Mr. Kennard.

In West Suffolk, it has been found in a probably post-Roman Lacustrine deposit at Knettishall.

In Cambridge, it is reported from a Lacustrine deposit of Romano-British age at Harlton.

In West Gloucester, Mr. Kennard reports it from the pre-Roman peat deposits at Westbury-on-Severn.

In Scotland, it is reported from an early Lacustrine bed at Elie, Fifeshire.

In Ireland, Mr. S. A. Stewart detected this species in the raised beach at Portrush, co. Antrim. Mr. A. W. Stelfox found it in the fossiliferous beds at Dogs' Bay, West Galway, and Mr. J. G. Milne in the deposits on the "Warren," Achill Island, West Mayo. It has also been found in the early alluvial deposits of the Shannon at Limerick, and from buried land surfaces of Neolithic age at Tranarossan and Rosapenna in co. Donegal.

In Germany, it is recorded from the tufaceous beds of Grenssen, near Sonderhausen, in Schwarzburg.

In France, it is recorded by von Ihering from the tufa of Ober-Zaunsbach, French Switzerland, and by M. Fagot with *Z. subradiatulus* from the quaternary grey clays of Hers, in Haute Garonne.

In Denmark, it is reported by Mr. Kennard from the Isle of Bornholm.

In the United States, Mr. Billups records "*Vitrea hammonis*" from the old forest bed on Ohio and Great Miami rivers, near Laurenceberg, Indiana, and it is also found in the post-glacial deposits of Michigan.

Variation.—The variability of *H. radiatula*, especially in the relative strength and distinction of the striation, is very considerable, and has been the chief basis upon which various forms have been differentiated. Mr. G. H. Clapp, of Pittsburgh, who has especially studied the forms assumed by this species in America, remarks that in the United States there appear to be two somewhat distinct geographical races.

The northern race shows a narrower umbilicus, with the spiral striation only faintly indicated or even quite absent. These are probably the true *Helix electrina* of Gould, being the form found living in Gould's original locality at Cambridge, Massachusetts. It is apparently distributed over the greater part of Canada, Alaska and the Middle and Northern States, but connects with the eastern race by the Virginian examples, which approximate to the smoother northern variety.

The eastern race, which appears to inhabit the coastal plain east of the Appalachians, has been noted from New Jersey, Virginia, and district of Columbia, passing in the south into Alabama, where it reaches its maximum development, shown by the possession of a wider umbilicus and a beautiful revolving microscopic sculpture.

Judging from the distribution of these forms, we may reason that the eastern form is the oldest and most primitive, occupying as it does the vicinity of the Appalachian region, which harbours the most primitive molluscan fauna (excepting only the desert areas), and that the northern form is the most modern and vigorous race.

In Europe, *H. petronella* would appear to represent the more ancient form of *H. radiatula*, which by stress of competition now chiefly inhabits the mountains, or the inclement regions more or less remote from the evolutionary centre. In its stronger spiral striæ, wider umbilicus and geographical range it bears a similar relation to the typical form that var. *circumstriata* from Alabama bears to the true *electrina*.

This spiral or revolving sculpture is variable but yet is generally distinguishable in British shells, though they lack the sharp and clear definition characteristic of the Alabama specimens.

In Belgium, according to Van den Broeck, the species exhibits similar characteristics, the examples from the mountainous region of the Ardennes showing a more strongly sculptured shell with a different facies to that exhibited by the individuals from the plains, in which the radial striation is much less definite.

The *Z. subradiatulus* Fagot, from mossy limestone rocks by the castle of Bramevaque in the Pyrénées, differs in its closer, finer, and more regular striation, and its slightly narrower umbilicus.

The *H. viridula* of Menke is probably quite identical with the var. *viridescens-alba* of Jeffreys, and will take precedence of that name.

VARIATION IN SHELL.

Var. *viridula* Menke.

Helix viridula Menke, Syn., ed. ii., 1830, p. 127.

Zonites radiatulus var. *vitrina* Gray's Turton's Manual, 1840, p. 174.

Zonites striatulus var. *albinos* Moq.-Tand., Hist. Moll. France, 1855, ii., p. 86.

Zonites striatulus mut. *vitrea* Schmidt.

Helix radiatula var. *concolor* Dum. and Mort., Hist. Moll. Savoie, 1857, p. 234.

Zonites radiatulus var. *viridescens-alba* Jeffreys, Brit. Conch., 1862, p. 160.

Original Description.—" *Helix viridula*, m. H. testa orbiculato-convexiuscula, umbilicata, tenui, glabra, pallide viridicante, pellucida, nitida; apertura subrotunda; labro simplici. Alt., 1 lin.; lat., $1\frac{3}{4}$ lin."—C. T. MENKE, Syn. Moll., 2nd ed., 1830, p. 127.

The sub-var. *viridescens-alba* Jeffreys is described as greenish-white.

The sub-var. *albinos* of Moq.-Tand. is described as entirely whitish.

The sub-var. *vitrina* Gray is described as transparent, greenish-white.

The sub-var. *concolor* Dum. and Mort. is described as pale, unicolorous, and hyaline. It is considered as a tendency to albinism induced by shade and moisture. The shell is often slightly larger than the type, but not so large as *H. petronella*, from which it differs by its slightly flattened last whorl and oval mouth.

The original description of Menke's *H. viridula* indicates the transparent pale greenish form, which Herr Clessin regards as the marsh variety of *H. pura*. I, however, agree with Dr. E. von Martens in thinking this form more correctly referable to *radiatula*, as English specimens of the undoubted var. *viridescens-alba* were found, after careful comparison by him, to be quite identical with authentic specimens of *H. viridula* preserved in the Berlin Museum. The view that *H. viridula* is synonymous with *H. radiatula* has also been adopted by American conchologists. The name in its strict sense is, therefore, adopted for the variety, superseding Dr. Jeffreys' name.

This variety is also probably the *Hyalina hammonis* var. *virescens* of Esmark.

ENGLAND AND WALES.

Devon N.—In woods with type at Countesbury, Aug. 1892, Lionel E. Adams.

Wilts. N.—Melksham, 1905! E. W. Swanton.

Wilts. S.—Dinton, 1905! Hugh Wyndham.

Essex S.—High Beach, Epping Forest, May 1906, J. E. Cooper.

Middlesex—Mill-Hill near Ealing, 1885, F. Fenn.

Bedford—Woburn Sands, Sept. 1905! F. H. Sikes.

Worcester—Turner street, Sparkbrook, Birmingham! W. Nelson.

Stafford—Caldon Low, Dec. 1888! and High Shut near Cheadle, T. F. Burrows.

Cannock Chase near Stafford, 1884, Lionel E. Adams.

Salop—(Jeffreys, Brit. Conch., 1862, i., p. 166).

Merioneth—Torrent Walk, Dolgelly, April 1888! G. W. Mellors. Fairly common at Fairbourne, Aug. 1907, A. H. Jowett-Murray.

Derby—Near Clifton, with type, Aug. 1889! Lionel E. Adams.

York N.E.—Gravel pit, Farwath Bridge, Aug. 1886! W. Denison Roebuck.

York S.W.—Roydhouse Wood near Huddersfield, April 1876 (Peace, Sci. Goss., July 1876, p. 161). Penistone, Nov. 1890, Lionel E. Adams; and Bulcliffe Wood, 1904! F. Booth.

York Mid W.—Shipley Glen near Bradford, Sept. 1882! W. West. Crossgates, Jan. 1894! W. Nelson. Rombald's Moor, Ilkley! F. W. Fierke.

York N.W.—Banks of river Clough near Low Fawes, Aug. 1887! B. Hudson.

Durham—Var. *Helix vitrina* Fér., Gibside Wood! (J. Alder, Suppl. Newcastle list, 1838, p. 340).

Cumberland—Very rare, Wreay Wood (Miss Donald, Cumberland list, p. 57).

Isle of Man—Peel, Aug. 1890, R. Cairns.

SCOTLAND.

Roxburgh—Sunlaws, June 1904 ! Rev. R. Godfrey.
Stirling—Near Stirling, Feb. 1894 ! A. McLellan.
Perth S. and Clackmannan—Strathyre near Callander ! W. Evans.
Perth Mid—Crieff, June 1904 ! Rev. R. Godfrey.
Aberdeen—(Jeffreys, Brit. Conch., 1869, v., p. 157).
Cantire—Tarbert, June 1886 ! T. Scott.

IRELAND.

Derry—Coleraine, rare, March 1884 ! Lionel E. Adams.
Antrim—More plentiful than the type, according to Stubbs and Adams. It is recorded by Mr. Welch from Kenbane Port, 1897, Glenshesk, 1898, Colin Glen near Belfast, 1899, Glenavey, 1900, Murlough Bay, 1901, and in the "shell pockets" at Whitepark, Sept. 1896; and by Mr. Standen from Torr Head and Ballintog in 1889.
Down—Glen Donard demesne, 1897; old wood in Belvoir Park, 1898; Bangor, 1899, and Fortbreda, 1900, R. Welch; Downpatrick marshes, Stelfox and Welch.
Armagh—Newry, June 1905 ! and Crossmaglen ! P. H. Grierson.
Monaghan—Carrickmacross ! and Isle Cremaclic, Oct. 1903 ! P. H. Grierson; Castle Blayney, 1906 ! J. N. Milne.
Tyrone—(Jeffreys, Brit. Conch., 1862, i., p. 166).
Donegal—Lough Eske, 1900; and Rosguill, 1903 ! R. Welch. Glen Lough, Sept. 1905 (A. W. Stelfox, Irish Nat., March 1906, p. 63).
Fermanagh—Crom Castle and Milltown, Aug. 1889, J. G. Milne.
Meath—Stamullen, Oct. 1904, and Moynalty, April 1905 ! P. H. Grierson.
Wicklow—Powerscourt Waterfall, April 1904, P. H. Grierson.
Kilkenny—Freshford, 1903 ! and near Attenagh ! P. H. Grierson.
Leitrim—Swiss Valley, 1904, R. Welch.
Sligo—Glencar, July, 1904 (Welch and Stelfox, Irish Nat., Sept. 1904, p. 186).
Mayo W.—Glen at Delphi, April 1897, R. Welch.
Galway W.—Barna, Aug. 1907 ! R. A. Phillips.
Galway E.—Woodford, Aug. 1907 ! R. A. Phillips.
Clare—Lahinch, 1900 ! P. H. Grierson.
Tipperary S.—Near Urlingford, May 1903 ! P. H. Grierson.
Tipperary N.—Borrisokane, Aug. 1907 ! R. A. Phillips.
Waterford—Youghal, Aug. 1902 ! P. H. Grierson. Glendine, July 1907 ! R. Standen.
Cork S.—Carrigrohane, Rostellan, and Ballinspittal, July 1907 ! (Welch and Stelfox, Irish Nat., Sept. 1907, p. 298).
Cork N.—Killeagh, Aug. 1902 ! and Macroom, May 1902, P. H. Grierson.
Kerry—More plentiful than type (Stubbs and Adams, Irish Nat., Nov. 1898).

CONTINENTAL DISTRIBUTION.

Germany—*H. viridula* in moist places under limestone debris at Eschenberg in Hesse by Menke, and from Bösingfelde in Lippe by Dunker. *Zonites striatulus* mut. *vitrea* is recorded from Silesia, the Harz Mountains, and Rhineland by Schmidt; from Thuringia by von Martens; as *H. pura* var. *viridula* from Saxony and Dantzic in West Prussia; as *Z. striatulus* var. *albinos* Moquin from Alsace by Meyer; as *H. radiatula* var. *viridula* from Sollinger Wald, Brunswick, by Döring; and as *H. radiatula* var. *virescens* from Gr. Raum, Fritzen'schen Forst, East Prussia, by Mr. H. Sell.

Belgium—*H. radiatula* sub-var. *concolor* D. & M. has been found by M. Purves at Roumont in Luxemburg.

France—*H. radiatula* sub-var. *concolor* is recorded for Savoy and Haute Savoie by Dumont and Mortillet; the var. *albinos* from the Vosges by Puton; as *H. viridula* Mke. from Bois de Chaville, and du Rainey in the department of the Seine; as *H. pura* var. *viridula* from the Drôme; and as var. *vitrina* Moquin from the environs of Puy, in Haute Loire.

Switzerland—Arollo in the canton of Valais, at an altitude of 7,000 feet, above the limit of trees, July 1903 ! E. Collier; and at Trient in 1906 by Mr. H. Watson. As *Z. viridulus* it is recorded by Bourguignat from Emmatten in Unterwalden and Seelisberg in Canton Uri; and by Charpentier for Devens in Canton Vaud.

Austro-Hungary—As *H. viridula* from Schludersbach in the Tyrol by Gredler.

Spain—*H. viridula*, Hospicio de Venasque in Aragon by Bofil, and Bosque de Barricaudo in Catalonia by Fagot.

Norway—*H. hammonis* var. *virescens*, Fagerheim near Tonsberg, province of Christiania (Esmark, Journ. of Conch., 1886, p. 103).

Russia—Recorded by Milachevich as *H. pura* var. *viridula* Mke. from the Montagnes des Moineaux, Biolkovo and Loujki, in the government of Moscow; as *H. hammonis* var. *viridula* Menke it is said to be found in Finland, chiefly in the Arctic regions; and also at Abastuman in Transcaucasia.

H. radiatula petronella Charp.*Helix petronella* Charp., in Pfeiffer, Mon. Helic. Viv., 1853, iii., p. 95.*Zonites dumontianus* Bourguignat, Mal. Aix les Bains, 1864, p. 26.*Helix petronella* var. *cenisia* Pollonera, Moll. Terr. viv. Piemonte, 1885, p. 11.

Original Description.—"402. *H[elix] petronella* Charpentier. T. umbilicata, depressa, tenuis, superne distincte et confertim plicatula, pellucida, virente-hyalina; spira convexuscula; sutura impressa, submarginata; anfr. 4 planiusculi, ultimus depresso rotundatus, non descendens, basi convexusculus; umbilicus angustus pervius; apertura parum obliqua, lunato-rotundata; peristome simplex, tenue, rectum, margine columellari superne vix dilatato. Diam., maj. 5, min. 4½, alt. 2½ mill. (Mus. Cuming).

Helix petronella Charpent., MSS.

Habitat in summis Alpibus Helvetiæ rarissime."—L. PFEIFFER, Mon. Helic. Vivent., 1853, iii., p. 95.

The var. *cenisia* Pollonera = *Hyalina dumontiana* Lessona, not Bourguignat, is hyaline, vitreous, narrowly umbilicated, mouth rounder and less oblique.

The *Z. dumontianus* is probably a small form of *radiatulus*, distinguished by its more distant costulations, narrower and less trumpet-shaped umbilicus, its less-dilated, perfectly rounded last whorl, and its aperture round and not oblong.



FIG. 135.—*Zonites dumontianus* Bourguignat, enlarged and natural sizes (after Bourguignat).

H. radiatula petronella was discovered by Venetz in 1820, and specimens were sent by Charpentier under the name of *Helix vitrina* to Férussac, who conserved the name in his great work. It differs from the typical form by its larger size, loftier spire, wider umbilicus, stronger spiral striation, its usually uniform greenish-white colour and almost hyaline transparency, but more especially by the aperture and last whorl being rounded instead of compressed and oval.

The radula of *H. petronella* extracted from a specimen sent from Dalarne in Sweden by Dr. Westerlund, is described by Heer Schepmann as showing a formula of $2\frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + 2\frac{2}{3}$ and as differing only slightly from those of Dutch specimens of *H. hammonis*, by the possession of six more longitudinal rows of teeth, which, though of slightly larger size, offered no characters for special diagnosis.



FIG. 136.—Representative denticles from a transverse row of the teeth of *Hyalinia petronella* Charp., from Dalarne, Sweden, per Dr. C. A. Westerlund, $\times 600$ (after Schepmann).

This form has been well studied, and some of its slighter local modifications have been noticed and named by various authors. Amongst others M. Bourguignat has described from Aix les Bains a *Zonites dumontianus*; another variety from Barcelona, which he has named *jacetanica*, Dr. Böttger affirms is but the usual horn-coloured form, and also states that *H. subnitidosa* Mousson is identical with it.

According to Westerlund, this form is plentiful throughout Finland and the whole of Scandinavia, extending also over the Kola peninsula in the government of Archangel in Arctic Russia. It is also found in Iceland, Ireland, South Wales, and throughout Middle and Southern Europe, almost always at considerable heights on the mountains, as in Saxon Switzerland; on the Styrian and Tyrolese Alps; on the mountains of South Germany. In the Valais and Savoyan Alps, where it exists at about 6,000 feet altitude, as well as in Piedmont, Switzerland, Auvergne, the Pyrenees, and the northern provinces of France.

This variety or geographical race, which, though showing certain slight differences in the shape of the shell and in its stronger spiral striation, may be regarded as the alpine form of *H. radiatula*, was dedicated by its author to the saint who, according to the legends of the Upper Valais, guards travellers over the Alpine passes.

It is distributed over the Alps and other elevated regions, but becomes more generally an inhabitant of the lower ground as the locality inhabited becomes more remote from the assumed evolutionary area, where it is sporadic and uncommon.

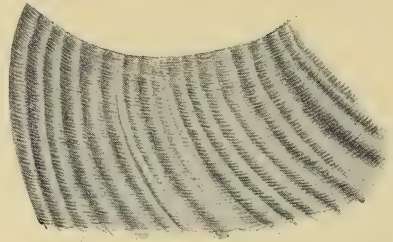


FIG. 137.—Surface sculpture of the body-whorl of *Hyalinia radiatula petronella* Charp., from Norway, Miss B. Esmark $\times 30$ (after micro-photo. by Mr. J. W. Jackson).

CONTINENTAL DISTRIBUTION.

Germany—Recorded by Reinhardt for a few places in the Spree Valley, on Steinetz See at Tasdorf; Oder Valley at Stendel near Passow, etc., and Borchering records it for Detmold. It is also reported from Kobyllno, Landeck, Liebnitz, etc., in Silesia; as rare at Erlach in Lower Franconia; from Kreuzberg in Lower Bavaria, and the Harz Mountains in Hanover.

France—Dumont and Mortillet record it as living above the forest line and up to the limit of shrubs at an altitude of over 6,500 feet in Val de Peisey in Savoy. The sub-var. *dumontiana* is found at Aix les Bains and in the alluvium of the lake near Cornin in Savoy, and is rare at Grande Chartreuse in the Isère.

Italy—It is found in Piedmont at Presolana, at an elevation of over 7,000 feet, while Dumont and Mortillet cite as a locality Alleé-blanche near the Châlets, and opposite the Glacier du Miage at more than 6,500 feet high. The shells recorded by Prof. Lessona as *H. dumontiana* from alluvium of Lago del M. Cenisio, at an elevation of about 5,000 feet in Valle di Dora Riparia, Piedmont, are described as new by Signor Pollonera under the name of *H. petronella* var. *cenisia*.

Switzerland—Charpentier records this form from the Val de Bagnes in Central Valais, and Dr. Gwyn Jeffreys from the Gorner Grat, Zermatt. In the Grisons, Rev. S. Spencer Pearce found it commonly at Casaccia in the Bergel Valley and Maloja, and Am Stein in the Munsterthal; and Blum reports it from Canton Glarus.

Austro-Hungary—Recorded from the Tyrol by Gredler; Galicia by Jachno; Styria by Westerlund, and from the Tyrol.

Spain—*Polita petronella* recorded from Seville in Andalusia by Kobelt; and the var. *jacetanica* from Barcelona by Bourguignat.

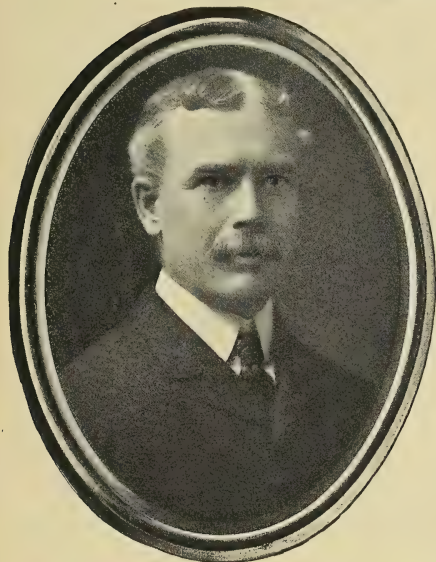
Norway—Very common throughout the country, extending to Tollaa $66^{\circ} 50'$, and Lofoten 69° , in Nordland, and up to 70° at Varanger Fjord in East Finmark.

Sweden—Diffused over the whole of the country, being cited by Wallenberg for Jockmock, and as frequent at Qvickjock, 67° north lat. in Lulea Lappmark; it is also recorded for provinces of Herjedalen, Vesternorrlands, Gefleborg, Kopparbergs, Warmland, Westmanland, Stockholm, Orebro, Ostergotland, Westergotland, Smaland, Gotesborg, Bohusland, Skane, and the Island of Gothland.

Russia—Recorded as found in Olonetz, Perm, Kursk, the Kola peninsula, and the shores of the White Sea in the government of Archangel, as well as throughout Finland. It is also recorded from Mamudly in Kutais; the var. *subnitidosa* has been found at Gortschka in Erivan; Kasbek, Kobi, Tabizhuri, and Suram in the government of Tiflis; and Russian Armenia; and the var. *jacetanica* at Tbatani.

In Siberia, according to Dr. Westerlund, it was recorded by Schrenk under the erroneous name of *H. pura* from the springs of Uderei and banks of the Murosch-naja in the Yenissei region; from Sludjanka in the Baikal region; and from the Stanovoi Mountains. It occurs also on the Yenissei at Pupkowskij, lat. $64^{\circ} 42'$; Nischnij Inbatsk, $63^{\circ} 50'$; Surgutskoj, $62^{\circ} 50'$; and Krasnojarsk, 56° . It was also found by Dr. Theel's expedition at Ansifforowa and Tshulkowa; and is tabulated for the Altai region, the basin of the Amour, and Kamtschatka.

Persia—The var. *subnitidosa* is recorded by Mousson from the shores of the Caspian Sea.

H. radiatula electrina Gould.*Helix electrina* Gould, Invert. Mass., 1841, p. 183, f. 111.*Hyalina viridula* Binney, L. & F. Shells of N. Amer., 1869, p. 34, f. 41-43.*Vitrea hammonis* Pilsbry, Nautilus, 1898, p. 129.*Vitrea radiatula* Dall, Land and Freshw. Moll. of Alaska, Harriman Exped., 1905, p. 38.

THIS interesting Nearctic race of *Hyalina radiatula* I have very great pleasure in associating with Mr. G. H. Clapp of Pittsburgh, U.S.A., an ardent and successful scientist, who is in the forefront of American conchology, and very intimately identified with the modern advancement of the study of the mollusca of the United States, and is doing so much excellent work to assist in the elucidation of the variation and also in the definition of more precise specific limits of the present and other species.

Original Description.—“*Hyalina electrina*. Shell small, depressed, pellucid, fragile, amber-coloured; whorls 4, conspicuously wrinkled by the lines of growth; aperture rounded; lip simple; umbilicated.”
—GOULD'S Invert. Mass., 2nd ed., 1870, p. 397, f. 656.

G. H. Clapp

Although Gould's original description of *Helix electrina* includes only the amber-coloured form, and Binney and Bland in their description of the same species under the name of *H. viridula* Menke are equally stringent in their limitations, yet this



FIG. 139.—Outlines of the upper, basal, and frontal aspects of *H. radiatula electrina* Gould, from Cambridge, Mass., $\times 5$. (After camera lucida drawings by Mr. G. H. Clapp).

variety or race also presents the horny and the crystalline forms, as in the typical *radiatula*, but the shell has been hitherto indiscriminately recorded in American literature under the various names of *electrina*, *hammonis*, *radiatula* and *viridula*, without any serious attempt being made to formulate or indicate the differences that exist in the striation and colour of the shell.



FIG. 140.—Outlines of the upper, frontal, and basal aspects of *H. radiatula electrina* var. *circumstriata*, from Wetumpka, Alabama, U.S. $\times 5$. (After camera lucida drawings by Mr. G. H. Clapp).

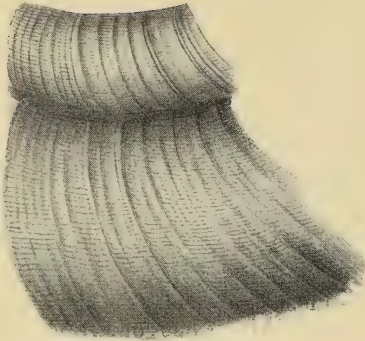


FIG. 141.—Surface sculpture of the ultimate and penultimate whorls of *H. radiatula electrina* var. *circumstriata*, Wetumpka, Alabama, Mr. Clapp $\times 30$. (After micro-photo by Mr. J. W. Jackson).

The JAW of *H. electrina* Gould is described by Binney and Bland as of an arcuate form, with attenuated and slightly recurved ends, anterior surface centrally striate, concave margin smooth with a median rounded projection, on each side of which are two notches.



FIG. 142.—Mandible or jaw of *H. electrina* $\times 25$ (after Morse).

The LINGUAL MEMBRANE is described by Morse, and has a formula of $27+1+27 \times 54=2,970$. The median tooth is broad and long, with a long and slender mesocone, with small ectocones near its base; laterals three each, with a well-developed mesocone, and well-marked ectocone, the two admedian teeth at each side long and narrow, the third smaller; the marginal teeth are simply aculeate.



FIG. 143.

FIG. 144.—Median, admedian, and marginal teeth of *H. viridula* (Menke) Binney, highly magnified (after Binney).



FIG. 144.

This form is undoubtedly diffused over the whole of the North American Continent, being reported from Point Barrow in the extreme north of Alaska, quite into Florida in the extreme south.

BRITISH NORTH AMERICA.

Alberta—Recorded as *V. radiatula* by Dr. Dall from Red Deer and from Laggan at an altitude of 5,200 feet in the Rocky Mountains.

British Columbia—Recorded as *V. radiatula* by Dr. Dall from Departure Bay, Comox and Union Bay, and as *V. hammonis* from Field by Vanatta.

Labrador—Recorded by A. S. Packard as *H. electrina* from Belles Amours.

Mackenzie—Recorded as *V. radiatula* from Fort Resolution on Great Slave Lake by Dr. Dall.

Manitoba—Mr. R. M. Christy records it as *H. viridula* from Lake of the Woods and Turtle and Pembina Mountains; also from a dry pond hole on prairie near Brandon, and commonly at roots of grass by a sleugh at Carberry; and Mr. Clapp reports it as *V. radiatula* from Winnipeg.

Ontario—*H. electrina*, St. Thomas, April 1886, T. D. A. Cockerell. As *H. viridula* it is recorded by F. R. Latchford from left bank of Rideau Canal, just below Bank street Bridge, near Ottawa; and Mr. Clapp reports it as *V. radiatula* from Bobcaygeon and Georgian Bay.

Quebec—As *Z. radiatulus* it is recorded by A. W. Hanham from the bar of Bay of Barachois, Gaspé, in May 1892.

Ungava—Recorded from Unga as *Z. radiatulus* by Dr. Dall.

UNITED STATES.

Alabama—*Zonites radiatulus*, Woodville (Sargent, Naut., 1892, p. 76). Var. *circumstriata* reported from Wetumpka! Jackson, Huntsville, and Princeton; by Mr. G. H. Clapp.

Alaska—Recorded as *H. electrina* from South-eastern Alaska, and at Klukwan, Portage Bay, and Seduction Point by the Brothers Krause, the Klukwan examples measuring 5.5 mill. in diam. The var. *alba* was found at Anuk, Kätlachia, and Killisnoo (Reinhardt, Sitz.-Ber. Ges. Naturf. Freunde, Berlin, 1883, p. 40).

Dr. Dall gives under the name of *V. radiatula* the further stations of Nulato on the Yukon, and Point Barrow on the northern coast; St. Paul, Kadiak Island; Unga Island, Shumagins; Unalaska, Aleutian Islands, Commander Islands, and Behring Island in the Behring Sea.

Arizona—*Z. viridulus* quoted by W. G. Binney (Manual Land Shells, 1885, p. 64).

Arkansas—*Z. viridulus* enumerated by Sampson from Benton, Carroll, Conway, Crawford, and Sebastian counties (Naut., July 1893, p. 33).

California—Reported as *Vitrea hammonis* from Bartles and Duck Lake in North California by R. C. McGregor; and as *V. radiatula* from Mt. Shasta by Mr. Clapp.

Colorado—Prof. Cockerell records it as *H. radiatula* from Buzzard's Creek, Mesa co.; Willow Creek and Smith's Park, Custer co.; at an altitude of 7,340 feet in Boulder Cañon, Boulder co.; near Cattle Creek, Garfield co.; and from Saguache co. (Ingersoll), South Park (Yarrow), and Pueblo co. The var. *alba* as var. *viridescens-alba* in Mesa co., and Smith's Park, Custer co.

Columbia—Var. *circumstriata* reported from Washington by Mr. G. H. Clapp.

Connecticut—*V. radiatula*, Branford, G. H. Clapp.

Florida—*Z. viridulus*, Waldo, Alachua co., rare, M. A. Mitchell.

Indiana—*Z. viridulus* enumerated for Henry co., by Mr. E. Pleas. Lawrenceburg, J. F. James. Very common in Franklin co. (Moore and Butler, 1885); and reported as *V. radiatula* from Culver by Mr. G. H. Clapp.

Illinois—*Z. viridulus* reported by W. A. Marsh as rather rare in Mercer co. and Henderson co.; as rare at Du Bois, Washington co., by A. A. Hinkley; and from Canton as *V. radiatula* by Mr. G. H. Clapp.

Iowa—*H. electrina* reported as rarely common about Davenport by W. H. Pratt. As *Z. viridulus* by H. Prime from Hardin co., and as rather rare in Louisa co. and Des Moines co. by W. A. Marsh.

Kansas—*Z. viridulus* found among river-bank rubbish (Binney & Bland, Manual of Amer. Moll., 1869, p. 35).

Maine—According to Morse, it is common throughout the state, being quite the commonest species in its northern parts, and very large at Fort Kent. Reported from Orono by Mr. Allen; Westbrook by Rev. E. C. Bolles; from Bethel by E. W. Roper; and as *Vitrea radiatula* from Norway, Kennsunkport, and Bartarbor by Mr. G. H. Clapp.

Massachusetts—*H. electrina* from margin of Fresh-pond, Cambridge, by T. J. Whittemore (Gould's Invert. Mass., 1870, p. 398). As *Z. viridulus*, not common at Westport, Bristol co. (J. H. Thomson, Journ. of Conch., 1885, p. 369). Mr. Roper reports it from Revere and from Sangus, Essex co.; and Mr. Walker from Amherst.

Michigan—As *V. hammonis* it is recorded as common and generally distributed throughout the state, being tabulated as existing in thirty-two of the eighty-four counties into which the state is divided (B. Walker, Moll. Michigan, 1906). As *Z. viridulus* it is reported for Ann Arbor by E. W. Roper; from Grand Rapids by H. Prime; and from Kent, Belleisle, Oakland, and Cheboygan co.'s, by B. Walker.

Minnesota—*Vitrea radiatula* common in company with the albino form about Belle and Clearwater Lakes in Wright co. (Sargent, Naut., 1895, p. 88). Type and var. *alba*, St. Paul, Oct. 1882, Arthur Krause (Reinhardt, l.c.).

Missouri—*Z. viridulus* recorded by F. A. Sampson as plentiful about Sedalia, Pettis co., and as found at Clinton, Henry co.; Nevada, Bates co., and around Pierce city.

Montana—*Vitrea radiatula*, Mingusville (Squyer, Naut., Oct. 1894, p. 64).

Nebraska—*H. viridula* common all over the state (Aughey, Bull. Surv. Terr., 1877, p. 698).

New Hampshire—Enumerated for Francetown by Mr. E. W. Roper.

New Mexico—*Z. viridulus*, Fort Defiance (Binney and Bland, Bull. Amer. Mus. N.H., 1901).

New Jersey—*H. radiatula*, Westville, Gloucester co. (Fox, Naut., Feb. 1891). Var. *circumstriata* reported from Port Oran by Mr. G. H. Clapp.

New York—As *H. electrina* recorded by Dr. J. Lewis as formerly abundant but now scarce in Herkimer co. As *Z. viridulus* it is recorded from Mohawk by Binney

and Bland; from Onondaga co. by Rev. W. M. Beauchamp; from Plattsburg by G. H. Hudson; from Cayuga Lake Valley by N. Banks; and from Monroe co. by J. Walton. As *V. hammonis* it is recorded by F. C. Baker from Hayden's Mills near Auburn; and as *V. radiatula* from Madison co. and Staten Island by Mr. Clapp.

Nevada—*Z. viridulus*, Lahontan area, W. G. Binney (Call, Bull. U.S. Geol. Surv., 1881, p. 24).

North Carolina—*V. hammonis* tabulated for Roan, Smoky, and French Broad Mountains (Walker and Pilsbry, Proc. Acad. Nat. Sci. Philad., June 1902).

Ohio—Recorded as *Z. viridulus* from Cincinnati, Hamilton co., by J. F. James; Kent, Portage co., by Mr. G. W. Dean; Columbus, Franklin co., by H. Moores; from Garrettsville by Mr. S. M. Luther; and as *V. radiatula* from New Philadelphia by Mr. G. H. Clapp.

Oregon—*Z. viridulus* quoted from Portland (Binney, Manual Land Shells, 1885).

Pennsylvania—*Vitrea hammonis*, near Leetsdale, Allegheny co., Nov. 1905; and Edgeworth, G. H. Clapp. Lansdowne Valley; Wissahickon; and near Falls of Schuylkill (Schick, Naut., April 1895, p. 135).

Rhode Island—*H. viridula* not common under logs, near Tiverton (Thomson, Journ. of Conch., 1885, p. 369); and reported as *Vitrea radiatula* from Warwick by Mr. G. H. Clapp.

Texas—*Z. viridulus* reported from Hempstead by F. A. Sampson.

Utah—*Z. viridulus* quoted by W. G. Binney (Manual Land Shells, 1885, p. 64).

Vermont—*H. viridula*, Hartland, B. P. Ruggles.

Virginia—Var. *circumstriata* cited from Ballston and Mt. Vernon by Mr. Clapp.

Geographical Distribution.—*H. radiatula* is evidently a very ancient species, as is testified by its wide distribution in temperate climes in both the Old and New Worlds and is truly circumpolar.

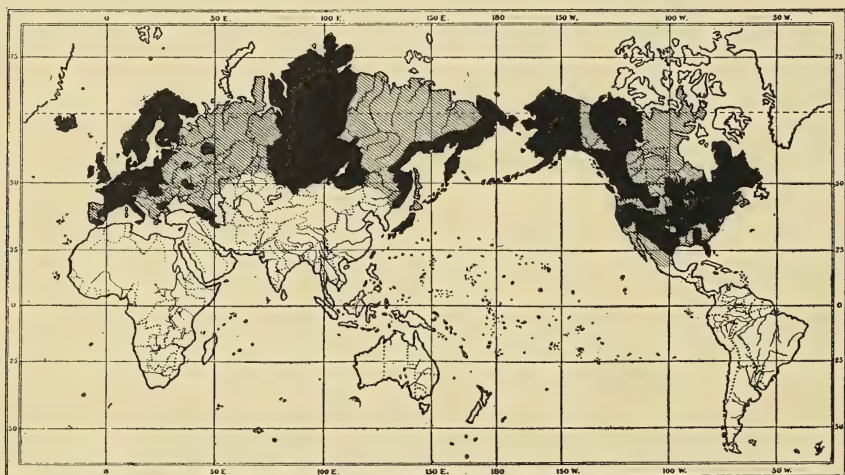


FIG. 145.—Map of the Geographical Distribution of the aggregate form of *Hyalinia radiatula* Alder.



Probable Range.



Recorded Distribution

It is diffused throughout the British Isles, its occurrence having been verified for almost every county and vice-county into which the country is divided, and according to Mr. R. Standen, it is very suggestive that in the south-west district of Ireland—one of the most primitive regions in the British Isles, where so many American types of plants and insects still linger—the great majority of the specimens of this species should be the greenish-white variety, which is the prevalent American form, and which is comparatively rare in other parts of Ireland and decidedly uncommon in England.

Under the name of *H. hammonis*, it is, according to Dr. Westerlund, found commonly all over Europe, from Iceland, Finnmarken, and Northern Finland to the southern branches of the Alps and South Russia.

ENGLAND AND WALES.

Channel Isles—Jersey, June 1905, F. H. Sikes. Moulin Huet, Guernsey, June 1904, Hugh Wyndham. Sparingly on the south coast, and at the Vale, Guernsey, but more plentiful in Alderney (Tomlin and Marquand, J. of C., Jan. 1903, p. 286).

PENINSULA.

Devon N.—Wood on north coast at Countisbury, Aug. 1892 ! Lionel E. Adams. Railway bank near Northam, July 1889 ! W. Gain. Belstone, Okehampton, Sept. 1904 ! Miss Daisy Mason. Lee ! Mrs. G. B. Longstaff. Common in moss on Lundy Island, Jan. 1907, J. R. le B. Tomlin.

Somerset N.—At roots of stunted grass in crevices of limestone rocks on Elton Hill, and in similar situations on the eastern scarp of Clevedon Hill, and also found near Clifton by Mr. W. Webster (A. M. Norman, Int. Moll. Som., 1860, p. 141).

CHANNEL.

Wilts. N.—Melksham, 1905 ! E. W. Swanton. Purton ! Rev. J. Goings.

Wilts. S.—Between Box and Corsham, also at Salisbury and Devizes (J. E. Vize, Wilts. Mag., ix., p. 278). Little Langford, May 1904 ! Hugh Wyndham.

Dorset—In a lane near Godlingston, Swanage (R. H. Soden-Smith); under moss, Whatcombe Park (J. C. Mansel-Pleydell, Dorset List, 1885). Bloxworth ! C. O. P. Cambridge; Leeson Wood, Mrs. Beccles; Langton-Maltravers, and Wilkes Wood (id., Moll. Dorset, 1898, p. 6). Weymouth (Damon, Geol. Dorset, 1884, p. 234).

Isle of Wight—Bembridge, A. G. More; near Ventnor, G. Guyon (Venables' Guide to Isle of Wight, 1860, p. 462). Yarmouth, 1866, Chas. Ashford. Ventnor, Apl. 1888 ! J. W. Wood.

Hants. S.—Crabbe Wood, near Winchester (Tomlin, Sci. Goss., 1883, p. 67). Gosport, J. E. Cooper.

Hants. N.—Swarraton, March 1888 ! Rev. W. L. W. Eyre.

Sussex W.—Ratham, Dec. 1881 ! W. Jeffery. Midhurst, Aug. 1884 ! T. D. A. Cockerell.

Sussex E.—Near Kingston and in Ashcombe plantation, Lewes (J. E. Harting, Zool., March 1878, p. 88).

THAMES.

Kent E.—Smeeth, Jan. 1883, Mrs. J. Fitzgerald.

Kent W.—Near Tunbridge Wells, May 1862 (J. G. Jeffreys, Ann. and Mag. Nat. Hist., July 1862, p. 76). Paddock Wood, Aug. 1884, and Chislehurst, Sept. 1885 ! T. D. A. Cockerell.

Surrey—Sandpits, Reigate Heath; Redhill, etc., common, G. S. & E. Saunders. Box Hill, Aug. 1883, E. H. Rowe. Oxted, Sept. 1884; Barnes, Dec. 1884 ! and Kew, Sept. 1886 ! T. D. A. Cockerell. Grayswood, E. W. Swanton, and Purley, K. McKean (Pannell, J. of Conch., April 1902, p. 170). Addington (id., op. cit., July 1903, p. 332). Haslemere, 1903 (id.).

Essex S.—St. Swithin's Meadows and Wanstead Park, but not abundant (Crouch, Essex Nat., 1890, p. 209). Warley, G. H. Clapp.

Essex N.—Colchester ! not rare (Laver, Essex Trans., 1882, p. 94). Walton-on-the-Naze, 1885 ! Rev. Churchill Babington. Common at Chignal St. James (R. M. Christy, Essex Nat., 1889, p. 8). Felstead Place Wood, not common (French, Essex Nat., 1888, p. 2).

Herts.—Near Otterspool and Berrywood, May 1875 (Lavis, Trans. Watford Soc., vol. i., p. 17, 1876). Ware, Dr. Gwyn Jeffreys. Banks of river Lea, Essendon, 1907, G. D. H. Carpenter.

Middlesex—Mill Hill near Ealing, June 1885, and Bedford Park, Chiswick, Feb. 1885 ! T. D. A. Cockerell.

Berks.—Bradfield near Reading, Rev. E. Peake.

Oxford—Not common in the bog between Elsfeld and Stow Wood (Whiteaves, Oxford List, 1857, p. 6). Not uncommon, Banbury (Stretch, 1855); Little Bourton; fairly common at Henley, well distributed but rare about Oxford (W. E. Collinge, Conch., 1891, p. 20). Howe Wood, Watlington, June 1908 ! W. Denison Roebuck.

ANGLIA.

Suffolk E.—Rejectamenta of river Alde, Blaxhall ! G. T. Rope. Saxmundham, Aug. 1890, L. E. Adams. Lowestoft, Mendlesham and Wickham Skeith (Mayfield, J. of Conch., Apl. 1903, p. 296).

Suffolk W.—Near Cockfield ! Rev. Dr. Churchill Babington.

Norfolk E.—Norwich, Mr. Bridgman (Lowe, Moll. Notts., 1853). Among dead leaves and moss, Whittingham Woods; under alders near Surlingham Ferry, and in wood near river, Costessey (Pearce and Mayfield, J. of C., July 1894, p. 391). Cringleford, Aug. 1890, Lionel E. Adams.

Norfolk W.—Ringstead ! Nar rejectamenta ! Narborough claypit ! and North Wootton, Sept. 1886 ! C. B. Plowright.

Cambridge—Cambridge, Aug. 1883, Griffith. Hauxton Mill ! H. Watson.

Bedford—Woburn Sands, var. *viridula*, Sept. 1905 ! F. H. Sikes.

SEVERN.

Gloucester W.—Bristol, Miss E. C. Jellie (Leipner's Bristol List, 1875, p. 282). Forest of Dean, March 1884 ! E. J. Elliott.

Monmouth—Bigswear, June 1880 ! C. T. Musson.

Hereford—Colwell at 900 feet altitude, Aug. 1885 ! C. T. Musson. Belmont, Hereford, Oct. 1886 ! C. B. Plowright. Under bark of willow trees, Doward Hill, Dormington (A. E. Boycott, Sci. Goss., Apl. 1893, p. 78). Sparingly under willow bark, at Whitchurch and Longworth (Boycott and Bowell's List, 1899, p. 28).

Worcester—Railway bank, Acock's Green ! Alcester road ! canal bank, Hay Mills ! and Greet ! all near Birmingham, W. Nelson.

Warwick—Beggary Green, Olton, near Birmingham ! and Stockingford near Nuneaton ! W. Nelson. Sutton Coldfield (H. Overton, J. of Mal., Sep. 1900, p. 171).

Stafford—Uncommon, near Cannock Chase, 1884 ! and Stafford Castle, 1885 ! L. E. Adams. Canal bank, Harborne ! Rushall canal, near Walsall ! and Hamstead, near Birmingham ! W. Nelson. Fairly common, Cheadle ; also found in Cottondale and Worth Wood, May 1898, J. R. B. Masefield. Stone, E. D. Bostock. Longdon, Guy Breeden.

Salop—Church Stretton (Gwyn Jeffreys, Ann. and Mag. Nat. Hist., 2nd ser., xvi., p. 464). Much Wenlock, 1884, E. Collier. Coppice at Plas-yn-Coed ! and hedge near Maesbrook, June 1885 ! Baker Hudson. Not uncommon, Carding Mill Valley, and Soudley (Buddicom's Church Stretton List, 1904, p. 183).

SOUTH WALES.

Glamorgan—Enumerated for Cardiff (Wotton, Br. Ass. Hdbk., 1891, p. 182).

Brecon—Velinnewydd (J. W. Vaughan, J. of Conch., 1904, p. 56).

Radnor—In moss, Cwm Bach dingle, Glasbury, J. W. Vaughan.

Carmarthen—Llandensant, near Llangadock, Oct. 1907 ! J. W. Vaughan.

Pembroke—Tenby, Sept. 1884 ! Howard Bendall.

NORTH WALES.

Montgomery—Bellan, near Welshpool, Sept. 1885 ! on rocks, Abernant, Llanfyllin ! and Dog Kennel's Quarry, Welshpool ! Nov. 1886, J. Bickerton Morgan. Efailwag, near Llanrhaidr-yn-Mochmant, July 1885 ! Baker Hudson.

Merioneth—Barmouth (J. Gwyn Jeffreys, Ann. & Mag. Nat. Hist., 1858, p. 47). Torrent Walk, Dolgelly, Aug. 1884 ! John Hopkinson.

Carnarvon—In wood by seashore, Llanfairfechan, Aug. 1883 ! John Hopkinson. Abersoch, near Pwllheli, Sept. 1906, G. D. H. Carpenter.

Denbigh—Great Orme's Head, Jan. 1888 ! Lionel E. Adams.

Anglesey—In damp wood by stream, Llandisilio, Aug. 1883 ! John Hopkinson.

TRENT.

Lincoln S.—Auster Wood, Bourn, Sept. 1897 ! W. Denison Roebuck.

Lincoln N.—About Brigg (T. Ball's List, 1864). Banks of canal, near Louth, April 1886 ! W. Denison Roebuck. Common, Donington-on-Bain, Aug. 1886 ! Welton Vale ! and plantation, near Fenney Wood near Louth, May 1887 ! H. Wallis Kew. Greenfield Wood, near Alford, June 1887 ! J. E. Mason. Grisel Bottom, 1902 ! C. S. Carter.

Notts.—Abundant among moss, at Wollaton and Highfield House, and sparingly at Oxtun, Stanton-on-the-Wolds, and Radford Grove (Lowe, Conch. Notts., 1853). Thrumpton ! and Beauvale ! April 1884 ; Tollerton ! Trent rejectamenta, Carlton ! and High Park Wood, Hucknall Torkard, 1883 ! Stanford, March 1884 ! and West Bridgford, near Nottingham ! C. T. Musson. Pleasley Vale, 1893, B. Sturges Dodd.

Derby—Dovedale (Brown, Ill. Conch., 1845, p. 84). Matlock, July 1864, Chas. Ashford. Repton, Mr. T. Hagger (Rev. H. Milnes, Midl. Nat., May 1882, p. 106). Cheedale, April 1884 ! W. West. Common, Belper, March 1884 ! C. T. Musson. Ambergate, Thos. Hey. Heath, Feb. 1884 ! E. Pickard. Moderately common at Clifton, Aug. 1889 ! and by river Dove, Rocester, Nov. 1898 ! L. E. Adams.

MERSEY.

Cheshire—Marple, rare, 1884, E. Collier. Moston, near Chester (Bellars, Ill. Cat. Brit. Shells, 1858). Congleton, March 1884 ! C. T. Musson. Knutsford Bog, Sept. 1885 ! T. Rogers. Rather scarce, Ashley Hall, Butt's Clough, Bollington, Hale, and Baguley Hall (Milne and Oldham, J. of Conch., Jan. 1894, p. 317). Poynton (J. W. Jackson, J. of Conch., July 1903, p. 336). Romiley, C. Oldham. Riversdale, near Oldham, F. Taylor. Weaverham and Barnton, B. R. Lucas.

Lancashire S.—Chaigeley (Lowe, Conch. Notts., 1853). Damp places in fields and woods near Jackson's Boat, Chorlton-cum-Hardy, etc. (J. Hardy, Manchester List, 1865, p. 36). Mode Wheel, Eccles, Aug. 1869, T. Rogers. Lea Green, near Liverpool, Rev. H. H. Higgins. Whalley, Feb. 1889 ! W. H. Heathcote. Not uncommon, Burnley (F. C. Long, Garner, Jan. 1892, p. 56). Locally common on canal bank near Bardsley Bridge, Oldham, April 1897 ! Fred. Taylor. Birch, Prestwich and Swinton, R. Standen.

Lancashire W.—Brockholes Wood, near Preston ! and Forton, near Lancaster, Feb. 1889 ! W. H. Heathcote. Preesal, near Fleetwood, July 1900 !

HUMBER

York S.E.—Flamborough Head, May 1886 ! W. Denison Roebuck.

York N.E.—In the Tees valley : Airey Holme Wood, near Guisborough (J. W. Watson, Nat., 1854, p. 229). Near Skelton, 1884 ; and Wilton Wood, near Redcar, 1886 ! Baker Hudson.

In the Derwent valley : Raincliffe Wood, Scarborough, April 1867, C. Ashford. Helmsley, July 1884 ! foot of Castle Hill, Pickering, Aug. 1886 ! and near Raskelf, Sept. 1882 ! W. Denison Roebuck.

York S.W.—In Airedale : Near Cullingworth, Aug. 1883 ! Shipley Glen, June 1883 ! and Nab Wood, June 1886 ! W. West. Bramley Fall Wood, May 1887 ! Woodlesford ! and Methley ! W. Nelson.

In Colne valley : At Roydhouse Wood, near Huddersfield ! J. Whitwham.

In Calderdale : In Haw Park, near Wakefield, Feb. 1882 ! W. Nelson.

In Don Valley : At Penistone, Cubley Wood and Gunthwaite, May 1890 ! Cawthorne, Nov. 1890 ; Conisbro' and Kiveton Park, July 1891 ! Lionel E. Adams. Found occasionally at Cusworth and Edlington (Corbett, Nat., June 1902, p. 205). Cantley Park woods, May 1883 ! and Doncaster, Sept. 1885 ! J. Ray Hardy. Amongst wet grass, Hemsworth, 1880, W. E. Brown.

York Mid W.—Common around York, as at Askham Bog wood, in woods about Knavesmire, and in Nova Scotia plantation (R. M. Christy, Zool., 1881).

In Ribblesdale : Helks' Wood, Ingleton, March 1883 ! Coat Rakes Bridge, Stocks-in-Bolland ! Forber Barn, Newton-in-Bolland ! and Cracow Hill, Tosside, Aug. 1885 ! W. D. Roebuck. Attermire Crags, Settle, April 1885, Rev. W. C. Hey.

In Airedale : At an altitude of 1,300 ft. near Malham Tarn, Sep. 1883 ! W. West. Norwood Bottoms, Thorne, June 1883 ! Bramham Park and Ray Wood, near Boston Spa, 1884, John Emmet. Ledstone, in old lime quarry, G. Roberts. Lime hills, Roundhay, March 1885 ! Meanwood Valley bogs, April 1885 ! W. Denison Roebuck. Adel Bog, Aug. 1882 ! and Manston, W. Nelson.

In Wharfedale : By river bank, Reynard Ings, near Addingham, Aug. 1886 ! Bolton Woods, March 1884 ! W. West. Barden, June 1883, G. Roberts. Dew Bottom Scar, Grass Wood, Aug. 1882 ! and Glaston Beck, Lindley Wood, April 1887 ! W. Denison Roebuck.

In Nidderdale : On limestone slope, by Manchester Hole, July 1886 ! W. Denison Roebuck. Ripley, Birstwith, and Hartwith, 1887 ! F. R. Fitzgerald.

In Wensleydale : Near Ripon, in 1871, H. Shaw.

York N.W.—In Lunedale : At Sedbergh, May 1887 ! W. Denison Roebuck. Low Fawes, Aug. 1887 ! Baker Hudson. Cantley Spout, Aug. 1887 ! W. West.

In Wensleydale : Hackfall, 1871, H. Shaw. Wensley, Sept. 1885, W. Webster. Coverdale, Dec. 1887, R. C. Chaytor. Stallingbusk, Aug. 1882, W. Denison Roebuck.

In Swaledale : At Reeth, A. S. H. Lowe (Lowe, Conch. Notts., 1853). Angram, July 1884 ! Gunnerside, near Isles Bridge ! and at Woodend, near Feetham, Aug. 1885 ! W. Denison Roebuck.

TYNE.

Durham—Bearpark, near Durham, Sept. 1887 ! Baker Hudson.

Northumberland—Near Newcastle, Alder Collection, Newcastle-on-Tyne ! Not uncommon in wet moss, J. Alder, Newcastle List, 1831. Shotley Bridge, W. H. Broadhead. West Woodburn, at base of cliff by the river, Sept. 1887 ! R. Howse.

Cheviotland—In several places around Alnwick ; Ratcheugh, Hulne Woods, etc. (G. R. Tate, Proc. Berw. Club, 1858, p. 112).

LAKES.

Westmorland and Lake Lancashire—Kendal (Lowe, Conch. Notts., 1853). Coniston, April 1887 ! S. C. Cockerell.

Cumberland—Silloth, at roots of grass on the sandhills (Miss Donald, 1885). Rather scarce among moss and dead leaves in woods at Blaithewaite and Hayton (id., 1882, p. 37). Millom, Sept. 1882 ! C. T. Musson. Rare, Wetheral Woods near Carlisle, Aug. 1883 ! Miss Jessie Hele.

Isle of Man—Peel, Aug. 1890, R. Cairns. Glen Maye, Sept. 1891 ! Curragh, June 1904 ! J. R. le B. Tomlin.

SCOTLAND.

WEST LOWLANDS.

Dumfries—Moffat, Jan. 1891 ! W. Evans.

Ayr—Ballantrae (Brown, Ill. Conch., 1845, p. 84). Near Skelmorlie, July 1889 ! A. Shaw. Portincross, March 1904 ! Rev. R. Godfrey.

Renfrew—Greenock, Jan. 1886 ! Alex. Somerville. Cloch, Aug. 1886 ! T. Scott. Shielhill Glen, Aug. 1886 ! W. Denison Roebuck.

Lanark—Falls of the Clyde (Brown, Ill. Conch., 1845, p. 84). Very plentiful in a small glen, Cadzow Forest, and in Calderwood Glen (J. Dougall, Glasgow List, 1869, p. 193). Kenmuir Bank ! F. G. Binnie.

EAST LOWLANDS.

Peebles—Common, West Linton, Sept. 1893, Rev. W. Turner.

Roxburgh—Sunlaws, with variety, June 1904 ! Rev. R. Godfrey.

Berwick—Frequent (G. Johnston, Proc. Berw. Nat. Club, 1838, p. 155).

Haddington—Luffness Links, Oct. 1893 ! W. Evans.

Edinburgh—Foot of Salisbury Crags, Aug. 1886 ! W. D. Roebuck. Dalmahoy ! Fairmilehead ! Lothianburn ! Blackford Hill ! Braid Hermitage ! Braid Hills ! Loganlee ! Pentlands ! and Gorebridge ! W. Evans. Midcalder, June 1904 ! Rev. R. Godfrey.

Linlithgow—Common, Dalmeny, Oct. 1902 ! W. Evans. Rare at Cramond Bridge and Kirkliston, June 1902 ; Bo'ness, March 1900 ; Bonytown, April 1900 ; Preston, June 1901 ; and Linlithgow Bridge, July 1901, Rev. R. Godfrey.

EAST HIGHLANDS.

Fife and Kinross—Tentsmuir ! W. Evans.

Stirling—Bardowie Loch ! and Drymen, June 1889 ! Alex. Shaw.

Perth S. and Clackmannan—Near Perth, Dec. 1884 ! H. Coates. Fenderbridge, Glen Tilt, Sept. 1898 ! Blairgowrie ! W. Evans.

Mid Perth—Crieff, April 1904 ! Rev. R. Godfrey.

Perth W.—Callander, April 1888 ! Alex. Somerville. Bridge of Allan, etc., Nov. 1894 ! G. McDougall. Pass of Leny, near Callander ! W. Evans. Braendam, Oct. 1898 ! W. Denison Roebuck.

Forfar—Broughtyferry, Jan. 1886 ! Alex. Somerville.

Aberdeen S.—Found near Seaton House, July 1842 ; near Inverury, by Mr. Leslie ; and by Miss Macgillivray in the den of Auchmedden, at Delgaty, parish of Turriff, and other places along our northern coast (Macgillivray, Moll. Aberdeen, 1843, p. 93). The Links, Old Aberdeen, Sept. 1886 ! C. B. Plowright.

Banff—Ballindalloch, May 1893 ! W. Evans.

Elgin—Near Elgin ! Rev. George Gordon.

Easternness—Dalwhinnie, at 1,200 feet altitude, June 1892 ! Kineraig by Kinnussie ! and Aviemore ! W. Evans.

WEST HIGHLANDS.

Main Argyle—In woods, Inverary, B. Sturges Dodd. Dalmally, June 1889 ! Alex. Shaw. Barbreck, June 1900, Rev. R. Godfrey. Oban ! Mrs. Janet Carphin. Rather plentiful in damp spot near "Dog Stone" ; scarce at Ardbhan Craigs and towards Loch Etive ; also on Isle of Lismore, near Kilcheran, Aug. 1903 (Standen and Hardy, Journ. of Conch., Oct. 1903, p. 269).

Dumbarton—Auchtentorlie Glen (J. Dougall, Glasgow List, 1869, p. 196).

Clyde Isles—Brodick, Isle of Arran, April 1895 ! W. Evans. Shore of Loch Fad, May 1887 ! and Rothesay, Isle of Bute, July 1887 ! A. Shaw.

Cantire—Tarbert, March 1886 ! T. Scott. Ronachan, Dec. 1905 ! Rev. J. Going.

NORTH HIGHLANDS.

Ross W.—Balmacarra, Aug. 1906, Rev. R. Godfrey.

Caithness—Dunbeath Castle, Aug. 1883 ! W. Baillie.

NORTH ISLES.

Hebrides—On south slope of Connacher, Island of Hirta, St. Kilda group, July 1905 ! J. Waterston.

Orkneys—Stromness, Sept. 1902 ! J. Waterston.

IRELAND.

ULSTER.

Derry—Common about Coleraine, Nov. 1885 ! Lionel E. Adams.

Antrim—Whitehall, Broughshane, June 1886 ! Rev. S. A. Brenan. Portnoffer, Giant's Causeway, 1893, B. Tomlin. Very common at Murlough, Glenshesk, and in the pockets at Whitepark, Sept. 1896, R. Welch. Torr Head and Ballintoy, 1889, R. Standen.

Armagh—Crossmaglen, Nov. 1903 ! and Armagh, Dec. 1904 ! P. H. Grierson.

Monaghan—Carriekmacross, July 1905 ! Anyalla, Castleblayney, and banks of Lough Cremartin, P. H. Grierson.

Tyrone—Strabane, June 1889, Rev. A. H. Delap. Baronscourt, Sept. 1904 ! R. Bell.

Donegal—Near Strabane, June 1889, Rev. A. H. Delap. On turf walls, Waterfoot, Aug. 1889 ! (J. G. Milne, Journ. of Conch., Jan. 1890, p. 170).

Fermanagh—Crom Castle and Miltown, Aug. 1889 ! J. G. Milne.

Cavan—Shercock ! and Virginia, May 1906 ! P. H. Grierson.

LEINSTER.

Louth—Townley Hall, May 1905 ! Dundalk ! Darver ! Ardee, 1904 ! Carlingford quarry, Feb. 1904 ! Blackrock, Nov. 1904 ! Lough Drumshallon ! Barneath ! and Dunany, 1907 ! P. H. Grierson.

Meath—Stamullen, Oct. 1904 ! Drogheda, Nov. 1904 ! Nobber, 1904 ! Athboy ! Moynalty ! and Trim ! April 1905 ! Longwood, March 1905 ! Laytown, June 1905 ! Blackrock ! and Summerhill, Nov. 1905 ! P. H. Grierson.

Dublin—Rare in a shady wood, Loughlinstown (W. W. Walpole, Zool., 1853). Howth, R. F. Scharff. In marsh, Bushy Park, Dublin, Sept. 1903 (Welch and Stelfox, Irish Nat., June 1904, p. 123).

Wicklow—Greystones, Woodenbridge, and on sandhills, Arklow, R. F. Scharff. Powerscourt, April 1904 ! and Enniskerry, Aug. 1904 ! P. H. Grierson.

Wexford—Kilmanock, New Ross, Aug. 1888 ! G. Barrett-Hamilton.

Carlow—Borris ! P. H. Grierson.

Kilkenny—Graignenamanagh ! Attenagh ! and Clogh, April 1902 ! Ardaloos ! Jenkinstown ! and Freshhill, May 1902 ! Muckalee ! Callan ! Innistige ! Ballyragget ! and Powerstown, 1907 ! P. H. Grierson.

Queen's Co.—(Brown's Ill. Conch., 1845, p. 84).

King's Co.—Edenderry, Nov. 1905, P. H. Grierson.

Westmeath—Multyfarnham, spring, 1897 (G. F. Farran, Irish Nat., July 1897, p. 200).

CONNAUGHT.

Leitrim—Mobill, July 1904 ! P. H. Grierson.

Sligo—Rosses Point ; Rockwood ; Glencar and Church Island, July 1904 (Welch and Stelfox, Irish Nat., Sept. 1904, p. 186).

Mayo W.—Dugort, Achill Island, Aug. 1886 ! J. G. Milne. Delphi, April, 1897 (R. Welch, Irish Nat., Nov. 1897, p. 304).

Galway W.—Roundstone, Aug. 1890 ! B. Sturges Dodd. Ballynahinch, Sept. 1902, B. Tomlin. Renvyle, R. F. Scharff. Barna, Aug. 1907 ! R. A. Phillips.

Galway E.—Under stones on shore of Lough Corrib, between the abbey and castle at Annaghdown, July 1895 (R. Standen, Irish Nat., Sept. 1895, p. 266). Clonbrock, June 1896, R. F. Scharff.

MUNSTER.

Clare—Lehinch and Ennistymon ! (P. H. Grierson, Irish Nat., June 1902).

Limerick—Limerick, 1886 ! Dr. W. H. Evans. In beechwood by old churchyard at Galbally, Nov. 1898 ; in Glen Currane or Carrigan (Annie L. Massy, Irish Nat., June 1899, p. 143).

Tipperary N.—Carrigahorig ! and Borrisokane, Aug. 1907 ! R. A. Phillips.

Tipperary S.—Grantstown, June 1885 ! R. Rimmer. Marlfield, June 1886 ; Glen Connor near Clonmel, Sept. 1888 ! and Glenabbey, Rev. A. H. Delap. Finnore, E. Waller. Walingford and Ballingarry, May 1903 ! P. H. Grierson.

Waterford—Laurel Bridge, Morgan's Glen, near Clonmel, July 1886, Rev. A. H. Delap. Cappoquin and Waterford, Nov. 1902 ! P. H. Grierson.

Cork N.—Midleton, 1902 ! Shanagarry ! and Castlemartyr, Aug. 1902 ; and Mallow, Oct. 1902 ! P. H. Grierson. Glengariff, R. F. Scharff.

Cork S.—Macroom, May 1902 ! river Lee, near Cork ! P. H. Grierson.

Kerry—Killarney, Sept. 1885 ! T. Rogers. Valentia Island, April 1888, Rev. A. H. Delap. Kenmare, 1898 ! R. Welch.

GERMANY.

Apparently distributed throughout the empire, and is known from Alsace, Bavaria, Bremen, Brunswick, Brandenburg, Franconia, Hanover, Hesse-Cassel, Holstein, Lippe-Detmold, Hesse-Nassau, Mecklenburg, Oldenburg, Posen, East, West and Rhenish Prussia, Suabia, Silesia, Saxe-Coburg, Saxony, Thuringia, Weimar, Westphalia, and Wurttemberg.

NETHERLANDS.

Holland—Reported for Gelderland, and by Dr. Jeffreys from the great wood between the Hague and Scheveningen in South Holland.

Belgium—Recorded as *Z. striatulus* from the provinces of Antwerp, Brabant, East Flanders, Hainault, Liège, Limburg, Luxemburg, and Namur.

FRANCE.

H. radiatula is widely dispersed throughout France, more especially in the wooded regions of its mountainous parts. Though said to be always rare, it is found throughout the Pyrénées, the Alps, the mountains of Auvergne, etc. It has been specifically reported for the following districts and departments:—Ain, Aisne, Allier, Aquitaine, Ardennes, Ariège, Aube, Aveyron, Auvergne, Calvados, Champagne Méridionale, Charente-Inférieure, Côtes du Nord, Côte d'Or, Finistère, Gard, Gers, Hautes Alpes, Haute Garonne, Haute Loire, Hautes Pyrénées, Haute Savoie, Hérault, Isère, Jura, Loire, Loire Inférieure, Lozère, Manche, Meuse, Morbihan, Nièvre, Nord, Oise, Puy-de-Dôme, Pyrénées Orientales, Rhône, Savoy, Seine, Seine Inférieure, Seine-et-Marne, Seine-et-Oise, Vendée, and Vosges.

SWITZERLAND.

Distributed all over the country, and has been found in the cantons of Appenzel, Berne, Geneva, Glarus, Grisons, Lucerne, St. Gall, Schwyz, Ticino, Unterwalden, Uri, Valais, and Vaud.

ITALY.

H. radiatula is recorded from Valle della Dora Riparia, Piedmont, at about 4,000 feet elevation; also recorded from Tuscany, and Emilia; as *H. hammonis* it is enumerated for Sicily by Platania; as *H. viridula* Menke it is recorded from the Val d'Avio in Piedmont, at an altitude of over 7,500 feet. As *H. petronella* it is also recorded from Presolana in Piedmont at a slightly less elevation than the locality for *viridula*.

SPAIN.

From Catalonia, M. de Chia records *Z. striatulus* for San Daniel near Gerona, and as *H. viridula* by M. Fagot for Bosque de Barriacado. In Aragon it is recorded as *H. viridula* by Bofil from the vicinity of the Hospicio de Venasque, while Dr. Kobelt reports it as *Polita petronella* from Seville in Andalusia.

BALKAN PENINSULA.

Roumania—Reported from Sinaja by Clessin.

AUSTRO-HUNGARY.

Moravia—Recorded by Reinhardt from the sub-alpine region of the Sudetic Mountains, where no tree or only *Pinus pumilio* grows.

Tyrol—Found in the Zillerthal, Aug. 1875 (Clessin, Nach., 1877, p. 44).

Galicia—Found plentifully at Skaly Paniénskie by Jachno.

Hungary—Recorded as *H. hammonis* from Trenesin, but its reported occurrence in Hohen Tatra is not confirmed by Hazay.

Carniola—Recorded as *H. hammonis* from Kronau and from Laibach by Stussiner.

SCANDINAVIA.

Norway—*H. radiatula* is apparently well distributed over the country, extending to the most extreme northern parts. As *H. hammonis* it is recorded for many places, but is not universal, but extends to Kistrand in Finmark at 70° 25' north lat.; the largest specimens, 4.5 mill. in diam., being found in lat. 68° 49'. at Trondenes, Nordland. As *H. petronella* it is said by Esmark and Hoyer to be very common in Arctic Norway. At Elvenaes in Tromsø, 69° 40', the specimens are of a beautiful greenish tint and strongly transversely striate.

Sweden—*H. radiatula* is recorded for Sweden by Dr. Jeffreys on the authority of Malm. As *H. hammonis* it is described as inhabiting all the southern and middle provinces, and according to Wallenberg extends to Lulea Lappland in the extreme north. As *H. petronella* it is also described as dispersed over the whole country, being frequent at Qvickjock in Lulea Lappland, 68° north lat., and reaching the most southerly limits of the country.

Denmark—*H. radiatula* Alder is, according to Mr. H. Sell, common in the northerly parts of Zealand, and is distributed over the most part of the island of Funen. In Jutland it is also common, especially in the eastern districts, and has been also found at Ronne, on the island of Bornholm. *H. viridula* is affirmed by Mr. H. Sell not to occur in Denmark.

It is also recorded for the Faroes and Iceland.

Distribution of *Hyalinia radiatula* (Alder)

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles		SOUTH WALES	
PENINSULA	41	Glamorgan	
1 Cornwall W.	42	Brecon	
2 Cornwall E.	43	Radnor	
3 Devon S.	44	Carmarthen	
4 Devon N.	45	Pembroke	
5 Somerset S.	46	Cardigan	
6 Somerset N.		NORTH WALES	
CHANNEL	47	Montgomery	
7 Wilts N.	48	Merioneth	
8 Wilts S.	49	Carnarvon	
9 Dorset	50	Denbigh	
10 Isle of Wight	51	Flint	
11 Hants S.	52	Anglesey	
12 Hants N.		TRENT	
13 Sussex W.	53	Lincoln S.	
14 Sussex E.	54	Lincoln N.	
THAMES	55	Leic. & Rutld.	
15 Kent E.	56	Notts.	
16 Kent W.	57	Derby	
17 Surrey		MERSEY	
18 Essex S.	58	Cheshire	
19 Essex N.	59	Lancashire S.	
20 Hertx.	60	Lancashire Mid	
21 Middlesex		HUMBER	
22 Berks.	61	S.E. York	
23 Oxford	62	N.E. York	
24 Bucks.	63	S.W. York	
ANGLIA	64	Mid W. York	
25 Suffolk E.	65	N.W. York	
26 Suffolk W.		TYNE	
27 Norfolk E.	66	Durham	
28 Norfolk W.	67	Northumb. S.	
29 Cambridge	68	Cheviotland	
30 Bedford		LAKES	
31 Hunts.	69	Westmorland	
32 Northampton	70	Cumberland	
SEVERN	71	Isle of Man	
33 Gloucester E.			
34 Gloucester W.			
35 Monmouth			
36 Hereford			
37 Worcester			
38 Warwick			
39 Stafford			
40 Salop			

SCOTLAND.

W. LOWLANDS		E. HIGHLANDS	
72 Dumfries	93	Aberdeen N.	
73 Kirkcudbright	94	Banff	
74 Wigtown	95	Elgin	
75 Ayr	96	Easterness	
76 Renfrew	97	W. HIGHLANDS	
77 Lanark	98	Westernness	
E. LOWLANDS	99	Main Argyre	
78 Peebles	100	Dumbarton	
79 Selkirk	101	Clyde Isles	
80 Roxburgh	102	Cantire	
81 Berwick	103	Edudes S.	
82 Haddington	104	Edudes Mid	
83 Edinburgh	105	Edudes N.	
84 Linlithgow		N. HIGHLANDS	
E. HIGHLANDS	106	Ross W.	
85 Fife & Kinross	107	Ross E.	
86 Stirling	108	Sutherland E.	
87 Pth. S. & Clkn.	109	Sutherland W.	
88 Mid Perth		CAITHNESS	
89 Perth N.		NORTH ISLES	
90 Forfar	110	Hebrides	
91 Kincardine	111	Orkneys	
92 Aberdeen S.	112	Shetlands	

IRELAND.

ULSTER		LEINSTER	
113 Derry	122	Louth	
114 Antrim	123	Meath	
115 Down	124	Dublin	
116 Armagh	125	Kildare	
117 Monaghan	126	Wicklow	
118 Tyrone	127	Wexford	
119 Donegal	128	Carlow	
120 Fermanagh	129	Kilkenny	
121 Cavan	130	Queen's Co.	
	131	King's Co.	
	132	Westmeath	
	133	Longford	
		CONNAUGHT	
	134	Roscommon	
	135	Leitrim	
	136	Sligo	
	137	Mayo E.	
	138	Mayo W.	
	139	Galway W.	
	140	Galway E.	
		MUNSTER	
	141	Clare	
	142	Limerick	
	143	Tipperary N.	
	144	Tipperary S.	
	145	Waterford	
	146	Cork N.	
	147	Cork S.	
	148	Kerry	

Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

RUSSIA.

This species would appear to be widely dispersed over the country, being recorded for Riga, Livonia; and specimens were found by Mr. L. E. Adams in Aug. 1907 near Libau! and with *H. viridula* reported by Mr. H. Sell from Spahren, Usmaiten See in Courland; as *H. pura* var. *viridula* Menke it is recorded from Moscow and Kovno; as *H. hammonis* from Esthland, Archangel, Olonetz, Finland, Perm, Kharkov, and Transcaucasia; while as *H. petronella* it is noted from Archangel, Olonetz, Finland, Kursk, Perm, and Transcaucasia.

Siberia—*Vitrea radiatula* is tabulated by Dr. Dall from the valleys of the Lena and the Amur.

H. hammonis is tabulated by Westerlund for East Siberia and the Amur region; the precise records being Nischnij Inbatsk, 63° 50', and the country between Krasnojarsk and Tomsk. Dr. Theel also found it at Melnitsa. The Amurland records rest upon the collections made by Maaek, at the junction of the Onon and Ingoda.

As *H. petronella* it is said by Westerlund to have been found by Schrenk, who recorded the specimens as *H. pura*, at the Uderei Springs and on the banks of the Muroschnaja in the basin of the Yenissei; from Sludjanka in the Baikal region, and from the Stanovoi Mountains near Udskoi Ostrog. It is also recorded by Westerlund for Pupkowskij, latitude 64° 42', Nischnij Inbatsk, 63° 50', Surgutskoj 62° 50', Krasnojarsk 56°, and Yenissei; and Dr. Theel's expedition added Ansifforowa and Tshulkowa to the known localities; while Prof. Mousson records *H. radiatula* = *petronella* from Vladivostok.

Kamtschatka—*Vitrea radiatula* is tabulated by Dr. Dall as having been found by Dr. Stegnejer at Petropavlovsk, and in the Arctic regions.

MONGOLIAN SUB-REGION.

Japan—*H. electrina* Gould reported by Mr. Arthur Adams from Kino-o-Sima (Ann. Nat. Hist., June 1868). Reinhardt regards these specimens as identical with those collected by Hilgendorf at Mohedsi near Hakodade, in Yesso, which he has described as *Hyalina radiatella*. Pilsbry in 1904 also described in the "Nautilus" a var. *radiata* from Toya and Kuziro.

NEARCTIC REGION.

British North America—As *H. radiatula* it is recorded in the provinces of Alberta, British Columbia, Ontario, Quebec, and Ungava. As *H. viridula* from Manitoba and Ontario. As *H. hammonis* from British Columbia; and as *H. electrina* from Labrador, Ontario, and the Great Slave Lake, in Mackenzie.

United States—This species is reported under the name of *radiatula* from Alabama, Alaska, Aleutian Islands, Arizona, California, Colorado, Connecticut, Commander Islands, Illinois, Indiana, Maine, Massachusetts, Michigan, Montana, New Jersey, New York, Ohio, Pennsylvania, and Virginia.

Under the name of *hammonis* it has been made known from Colorado, Michigan, New York, North Carolina, and Pennsylvania.

As *H. electrina* it has been noted to occur in the Gulf States, Alaska, Behring Islands, Colorado, Iowa, Maine, Massachusetts, Minnesota, Missouri and New York.

As *H. viridula* it has been recorded as found in Arizona, Arkansas, Florida, Illinois, Indiana, Kansas, Maine, Massachusetts, Michigan, Missouri, Nebraska, Nevada, New Hampshire, New Mexico, New York, Ohio, Oregon, Texas, Utah, and Vermont.

Signature of André Etienne Just Paschal Joseph François d'Audebart, Baron de Férussac, author of the *Histoire Naturelle Générale et Particulière des Mollusques Terrestres et Fluviales*, in whose honour were named the Genera *Daudebardia* and *Ferussacia*.

SUB-GENUS *Vitrea* Fitzinger.***Hyalinia crystallina* (Müller).**

- 1774 *Helix crystallina* Müller, Verm. Hist., ii., p. 23, no. 223.
 1821 — *eburnea* Hartmann, Neue Alp., i., p. 234.
 1827 — *vitrea* Brown, Edinb. Journ., i., p. 12, pl. i., f. 12-14.
 1833 *Vitrea crystallina* Fitzinger, Syst. Verzeichn., p. 99.
 1837 *Helicella crystallina* Beck, Ind. Moll., p. 7.
 1837 *Polita crystallina* Held, Isis, p. 916.
 1840 *Zonites crystallinus* Gray, Turt. Man., p. 176, pl. iv., f. 42.
 1855 — (*Aplostoma*) *crystallinus* Moq.-Tand., Hist. Moll., ii., p. 89, pl. ix., ff. 26-29.
 1864 — *eustilbus* Bourguignat, Moll. Alg., i., p. 76, pl. iv., ff. 11-16.
 1871 *Hyalina* (*Euhyalina*) *crystallina* Kobelt, Catal. Europ. Binnenconch., p. 5.
 1875 — *crystallina* Weinland, Weichth. Schwab. Alb., p. 37.
 1881 — *cavannei* Paulucci, Bull. Soc. Mal. Ital., p. 80, pl. 1, f. 3.
 1877 *Hyalinia crystallina* Westerlund, Faun. Eur. Moll. Extram., p. 26.



HISTORY.—*Hyalinia crystallina* (*crystallinus*, clear or like crystal) is the type of Fitzinger's genus *Vitrea*, a group erected by him solely for *H. crystallina*, and which is characterized by its small, crystalline, and closely-coiled shell.

Westerlund has divided *Vitrea* into four sections: *Crystallus* Lowe, and *Anomphala*, *Hydatina*, and *Monadea* Westerlund, the present species being regarded as the type of *Crystallus*.

According to Mr. George W. Tryon, M. Mabilie has described as new under the name of *Hyalina secernenda*, the figure of *H. crystallina* in Alber's Malac. Maderensis, but the illustrations in this work are often inaccurate, and do not afford reliable specific characters.

The Algerian *Z. eustilbus* described as differing from *H. crystallina* by the rounder base, and the more rapid increase of the whorls, does not seem to differ from typical British shells.

The *H. humulicola* Mabilie (Hist. Mal., 1870) described as narrowly perforate, with less convex whorls, a more convex base, and a rounded unlabiate aperture, would seem also to agree with the present species.

H. crystallina was first noticed as British by Dr. Gray, who, in 1821, recorded the species in the "Medical Repository."

This species is associated with the Marchioness Paulucci, the gifted authoress of many important and valuable works upon the shells of Italy, and who has devoted especial attention and study to the terrestrial conchological fauna of Sardinia and the province of Calabria.

Diagnosis.—*H. crystallina* is distinguished from all its allies by the small size and greenish-white transparency of its shell, as also by the greater number and closer coiling of its whorls, which increase in size with remarkable slowness.

Anna Paulucci.

via Parisiatischi Bimenes

Description.—The ANIMAL is of a semi-translucent greyish-white, slighter darker above; MANTLE thin, translucent with minute milk-white specks; FOOT whitish, narrow and acutely pointed behind; OMMATOPHORES moderately long, black or blackish, due to the eye retractors which also show as a pair of parallel dark lines through the skin of the back; EYES jet black and very distinct.

SHELL slightly convex above and more convex beneath, and without basal opacity; thin, brilliantly glossy, transparent, greenish-white, or quite crystalline, and occasionally somewhat opalescent, becoming quite opaque after the death of the animal; very finely and minutely striate in the line of growth, and slightly

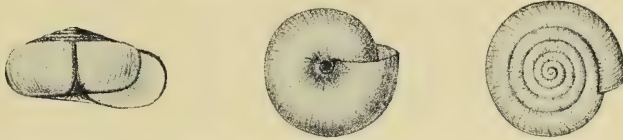


FIG. 147.—*Hyalinia crystallina* Müll., showing frontal, basal and upper aspects, $\times 6$ (after Clessin).

puckered at the sutures; EPIDERMIS very thin; WHORLS $4\frac{1}{2}$ –5, very slowly and regularly increasing in size; SPIRE slightly raised; SUTURE distinct; MOUTH semilunar, sometimes with a slight internal thickening or rib; the under surface without any opacity, and the UMBILICUS narrow and almost punctiform.

Diam., $3\frac{1}{2}$ mill.; alt., $1\frac{3}{4}$ mill.

When containing the living and retracted animal, the shell appears of a translucent white, becoming pale yellowish-brown on the inner whorls; the black eye-specks are visible through the shell-wall, they lie beneath the periphery of the shell, half-a-whorl from the aperture and about two millimetres apart.

The JAW or mandible is slightly arched or flatly crescentic, of a very pale amber or almost colourless and translucent, the ends are rounded and there is a very broad and blunt median projection or beak in the middle of the concave margin; the elasma is delicate and colourless.

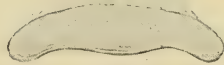


FIG. 148.—Mandible or jaw of *Hyalinia crystallina* $\times 50$ (Shipley, Yorks., Mr. F. Booth) from a preparation by Rev. Prof. Gwatkin.

The LINGUAL RIBBON is described by Dr. Lehmann as somewhat linear in shape, and bearing about eighty transverse rows of about thirty teeth each. The median tooth is simply conical, with a strong mesocone and a smaller ectocone at each side, borne upon a quadrate base, and is smaller than the adjacent teeth. The laterals are also borne on a quadrate base, and possess a conical mesocone, and are described and figured as with an endocone and ectocone. The marginals are elongate, but strictly aculeate, and supported on an acutely triangular base.

Herr Clessin describes the dentition as consisting of a median tricuspid tooth, three lateral teeth with two to three cutting points and eighteen aculeate marginals, and Heer Schepmann similarly describes the lingual armature of *Hyalinia subterranea*; the laterals in this species are, however, not really tricuspidate as described, the endocone being apparently constituted by the inner angle of the basal plate. A specimen from Shipley Glen, Yorkshire, showed a trifold mid-tooth, three bicuspidate laterals, and sixteen marginal teeth.

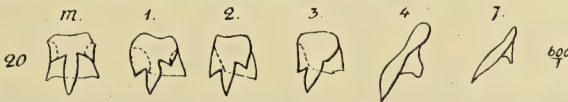


FIG. 149.—Representative denticles from a transverse row of the teeth of *Hyalinia crystallina* var. *subterranea*, from Rhoon, near Rotterdam $\times 600$ (after Schepmann).

The ALIMENTARY SYSTEM of the var. *subterranea* is described by Dr. Lehmann as showing a whitish OVOTESTIS with direct SALIVARY DUCTS, $2\frac{1}{2}$ mill. in length; the CROU is somewhat curved and delicately spotted with white, the cardiac end narrows abruptly, and shows a small cæcum, while the pyloric end is somewhat sac-like; the INTESTINAL TRACT makes two turns within the digestive gland; the DIGESTIVE GLAND or liver is finely granular in substance, of a pale brownish or yellowish-grey with white fleckings; the RENAL ORGAN or kidney is large and somewhat triangular, with thickened ends, of a granular consistency, and of a greyish-white colour.

The REPRODUCTIVE ORGANS exhibit an OVOTESTIS composed of minute milk-white follicles, with a moderately long and convolute HERMAPHRODITE DUCT; the ALBUMEN GLAND is large, finely granular, and of a yellowish tint; the PROSTATE or sperm-duct is narrow and milk-white, and is continued as a fairly long VAS DEFERENS, which enters the penis-sheath at its distal end, where the long and



FIG. 150.



FIG. 151.



FIG. 152.

FIG. 150.—Sexual organs of *Hyalinia crystallina*, much enlarged (after Lehmann).

FIG. 151.—Sexual organs of *Hyalinia crystallina* v. *subterranea*, much enlarged (after Lehmann).

FIG. 152.—Alimentary system of *Hyalinia crystallina* var. *subterranea*, much enlarged (after Lehmann), showing also the buccal bulb and salivary glands.

thin retractor muscle is also fixed; the PENIS-SHEATH is somewhat uniformly cylindrical, tapering towards the distal rounded extremity; the UTERUS is thin walled, slightly but broadly sacculate, gradually tapering below and passing into the FREE OVIDUCT; the SPERMATHECA is a small, transparent, and elliptical vesicle, borne upon a thick stem.

Reproduction and Development.—No observations have been made on the reproduction or development of this species, but the Rev R. Godfrey observed the species pairing in Ayrshire at the end of March, and Mr. F. Booth has remarked on its probably having a longer life term than some of its allies, as it may be found full grown at all times of the year.

Habits, Habitat, etc.—*H. crystallina* is a timid but very active and hardy species, very indifferent to cold, and forming but a very delicate and filmy epiphyragm.

According to Mr. J. W. Watson, who has especially studied the subject, its heart contracts at the rate of once per second at a temperature of from 60° to 65° Fahr.

It is said to feed upon decaying leaves and other vegetable debris, is quite subterranean in habit, and has actually been found living in company with *Cæcilianella acicula* among the roots of *Aspidistra lurida*, quite six inches below the surface of the soil.

It sometimes abounds in the alluvia of rivers and streams, but owing to its burrowing habits is not so frequently found above ground in any abundance, where it lives among moss, herbage, decaying wood and leaves, fallen branches of trees, etc., in wet meadows, or in woods even of coniferous trees. It is, however, sometimes found in dry situations even on the summit of ivy-clad walls.

The var. *subterranea* is recorded by Sandberger as living within masses of *Sphagnum* in a very moist woodland meadow in Adamsthal, near Wiesbaden, in Nassau.

Though normally an inhabitant of the moist plains, it has been noted as inhabiting the zone of *Helix fontenillei* at an altitude of 5,000 feet in the Alps, always preferring moist localities, and frequently burrowing beneath the surface of the soil.

Geological Distribution.—*H. crystallina* has been detected in the fossil state in the Lower Pliocene deposits of France, but in this country it has not been authentically reported from beneath Pleistocene strata, although the late Mr. Searles V. Wood in his great work on the Crag Mollusca, comments on the finding of *H. crystallina* in association with *Cyclostoma elegans* in the upper layers of the Coralline Crag, but he regards their presence there as probably adventitious and that the material in which they were found was in all likelihood a disturbed deposit of a more recent period.

LOWER PLIOCENE.—Sandberger records this species as found in the Lower Pliocene strata of Hauterive in the department of the Drôme and from those of Celleneuve in the Hérault.

PLEISTOCENE.—*H. crystallina* is reported as having been found in these deposits at several places all in the south-east of England.

In Sussex W., it has been found by Mr. J. P. Johnson in the buried river-bed deposit on the foreshore at West Wittering.

In Kent W., recorded from the famous Ightham fissure, near Wrotham, by Mr. W. J. L. Abbott; and in East Kent by Prof. Morris from the fresh-water deposits at Maidstone.

In Essex S., recorded from the Palæolithic deposit at Uphall brickyard, Ilford, by Mr. J. P. Johnson, and from the freshwater marls of Clacton and Copford, in North Essex, by Prof. Morris.

In Cambridge, found in the gravels of Barnwell Abbey and Grantchester by Rev. E. S. Dewick and Mrs. McKenny Hughes.

In Germany, Sandberger records *Hyalinia crystallina* as not rare in the Lower Pleistocene sands of Mosbach, Baden; as not common in the Mid Pleistocene beds of Cannstadt, Thuringia; the loess of Oos and Grotzingen in Baden; and Robschutz, Zscheilitz, and Niederjähna in Saxony. Herr Clessin has found it in the tufa beds of Regensburg, Bavaria; and Sandberger records *H. subterranea* in the valley loess of Heidelberg.

In France, Sandberger records it as scarce in the Mid Pleistocene beds of Hauterive in the Drôme, and Celleneuve in the Hérault; Locard from those of Celle, Seine et Marne, and from the bone breccia of Bastia in Corsica.

In Austro-Hungary, Clessin quotes it from the loess of Heiligenstadt near Vienna.

In Switzerland, it is recorded from the loess of St. Gall by Sandberger.

In Madeira, one example thought to be from the compact layer of fine sand at the base of the Upper Pleistocene fossiliferous beds at Caniçal (R. B. Watson, Journ. de Conch., 1876, p. 222).

HOLOCENE.—In Somerset S., it is reported from a rainwash of probably no great age at Alcombe, near Minehead.

In Wilts. N., also from a similar deposit at Little Bedwyn, and

In Dorset from the tufaceous beds at Blashenwell, near Corfe Castle, all by Mr. A. Santer Kennard.

In Hants. S., common in tufa at Netley Shoal, at Mottisfont in the Test Valley, and rare in tufa at Southampton Dock (J. T. Kemp, Proc. Hants. Club, 1889).

In the Isle of Wight, it is recorded from a tufaceous deposit south-west of Widdick Chine, Totlands Bay (Kennard & Warren, Geol. Mag., 1904).

In Kent W., it has been found in rainwashes of probably the Bronze-age at Exedown, near Wrotham, and at Greenhithe, and in a post-Roman rainwash at Otford; it is also recorded by Kennard and Woodward as common in the old soil at the base of an interment of early Romano-British age in Stanley's quarry, Ightham; Mr. F. C. J. Spurrell has found it in the section through the sandy deposit at the reservoir of the Metropolitan Southern Sewer Outfall at Crossness. In East Kent, it is reported by Mr. Kennard from a post-Roman rainwash at Charing.

In Surrey, found by Rev. R. A. Bullen at 2-3 feet deep in a Holocene rainwash, Colley Pit, Reigate; also found in a similar deposit by the Pilgrims' Way, near Reigate, by Mr. L. E. Adams; while Mr. Kennard reports it from a "pipe" of uncertain age in the chalk at Walton Heath, from a post-Roman rainwash at Titsey, and in the fluvatile carbonaceous silt disclosed in the excavations in Tooley street, Bermondsey, as well as from the sandy loam or marshy-clay bed beneath.

In Essex S., recorded from a section through the alluvial peat and marl deposits at the East London Waterworks, Walthamstow, by Mr. B. B. Woodward; found in peaty mud and sand at Tilbury Dock by Mr. F. C. J. Spurrell; and in the alluvium at New Park, near the White Horse, Lea Marshes, by Dr. Corner. In North Essex, Mr. R. M. Christy reports it from the alluvial deposit at Duke's Farm, Roxwell; as rare in the post-glacial black-earth and peat, but common in the overlying shell-marl at Chignal St. James. Mr. French has found it in the alluvial shell-marl of Felstead, and the Rev. A. J. Law in the alluvial deposit of a drain by "The Marsh," near Shalford Vicarage.

In Middlesex, Mr. Loydell has found it in the old river-bed, a mile west of Staines, on the tow-path to Old Windsor; Mr. J. E. Cooper records it from excavations near the Gas-works, Staines; Mr. Meyer from the site of Charing Cross Railway, Blackfriars; Mr. A. S. Kennard in an alluvial deposit of the river Colne of post-Roman age at Uxbridge, and from a deposit of probably Bronze-age at Clapton.

In Berks., Mr. Kennard reports it from a Neolithic bed at Newbury.

In West Suffolk, Mr. Kennard reports it from the bed of a now drained lake of probably post-Roman age at Knettishall.

In Cambridge, it has been found in a deposit of Romano-British age at Harlton.

In East Gloucester, it is recorded by Hinton and Kennard from the gravel-pit, the quarry tip, the old soil, and from the stone band above the old soil at Cleeve Hill. In West Gloucester, Mr. Kennard also reports it from the pre-Roman peat deposits at Westbury-on-Severn.

In Derby, Mr. Kennard reports it from tufa beds of uncertain age at Matlock.

In Yorkshire S.W., it has been found by Dr. Corbett thrown up by the moles in an ancient lacustrine deposit at Askern near Doncaster.

In Scotland, it is reported from an early lacustrine bed at Elie, Fifeshire.

In Ireland, it is reported from Whitepark, Antrim; and from the buried land-surfaces of Neolithic age at Tranarossan and Rosapenna, co. Donegal. Mr. Milne has discovered it in the sandy deposit on the Warren, Achill Island, Mayo W.; and Mr. Stelfox in the fossiliferous beds of Dog's Bay, West Galway.

In Germany, it is recorded with *H. subterranea* by Dr. Kobelt from the loess of the Rheingau in Nassau.

In Belgium, it is found very commonly in the "Tourbe" of Uccle les-Bruxelles by Grégoire.

In France, M. Locard records it from the Upper Tertiary Freshwater Molasse strata of the Dauphiné and near Lyons; by Tournouier it is cited from the tufa of La Celle near Moret, Seine et Marne; by Picard from the quartzose sands of Menchecourt in the Somme; and by Von Ihering from the tufa of Ober-Zaunsbach, French Switzerland.

In Denmark, it is reported by Mr. Kennard from the site of an ancient "kitchen-midden" at Meilgaard on the north coast of Jutland, and from deposits of the Stone age in Bornholm.

Variation.—*H. crystallina* tends to be of a more generalized form and according to Dumont and Mortillet has its specific characters more faintly developed in mountainous regions than in the plains, yet the variation is very restricted, as no striking modifications in the colour have yet been chronicled, the nearest approach being the opaque white form, resulting from a larger proportion of calcareous matter being incorporated with the shell substance.

The closer or looser coiling of the whorls, resulting in a wider or a narrower umbilicus, is the feature which has been chiefly noted for varietal differentiation, though Baudon has instituted a var. *nitidissima* for the small and unusually glossy individuals found in stony places at Garenne d'Houdainville in the Oise.

VARIATION IN SHELL.

Var. *contracta* Westerlund.

Zonites crystallinus var. *contracta* Westerlund, Fauna Moll. Suec., 1873, p. 56.

Hyalina contracta Clessin, Jahrb. Mal. Gesellsch., 1875, pl. 2, f. 1, p. 32.

Hyalina dubrueili Clessin, Mal. Bl., 1877, pl. 1, f. 4, p. 128.

Differs from the typical *crystallina* in its smaller shell, narrower umbilicus, the still more gradual increase in size of the whorls, the last hardly exceeding the penultimate in diameter, and in possessing an additional whorl.

The *H. crystallina* var. *subrimata* Reinh. is possibly practically identical with the var. *contracta*, differing chiefly in its somewhat looser coiling.



FIG. 153.

FIG. 154.

FIG. 153.—*H. contracta* Clessin, showing frontal, basal, and upper aspects, $\times 6$ (after Clessin).

FIG. 154.—*H. dubrueili* Clessin, showing frontal, basal, and upper aspects, $\times 6$ (after Clessin).

The sub-var. *dubrueili* is said to differ from var. *contracta* only in its slightly wider umbilicus and rounder ultimate whorl.

ENGLAND AND WALES.

Devon S.—Haldon and Stoke woods (Marquand, J. of Conch., 1889, p. 138).

Devon N.—Vellacot's Pool, near Rockford, April 1908! A. H. Jowett-Murray.

Somerset N.—Near Minehead, Aug. 1892! C. Oldham.

Wilts. N.—Purton Marsh! and Braydon woods, Apl. 1907! Rev. J. Going.

Surrey—Putney, July 1888! G. K. Gude.

Norfolk E.—Whitlingham woods, Rev. S. S. Pearce. Costessey! A. Mayfield.

Montgomery—Abernant, Llanfyllin, Nov. 1886! J. Bickerton Morgan.

Derby—Moderately common, Clifton, Aug. 1889! Lionel E. Adams.

Lancashire S.—Brockholes wood, near Preston, Feb. 1889! W. H. Heathcote.

Lancashire Mid—Farington, Feb. 1889! W. H. Heathcote.

Durham—Finchale Abbey, June 1885! Baker Hudson.

Isle of Man—Among moss on cliffs overlooking the sea, Glen Maye, Sept. 1891!

SCOTLAND.

- Ayr**—Near Skelmorlie, July 1889 ! Alex. Shaw.
Lanark—Falls of the Clyde near Lanark, Aug. 1886 ! Baker Hudson. Near Blantyre, Sept. 1888 ! Alex. Shaw.
Haddington—Binning woods ! Rev. Dr. McMurtrie.
Edinburgh—Roslin Castle ! Balerno ! Gorebridge ! Braid Hermitage ! Dalmahoy ! and Craiglockhart Hill woods ! W. Evans.
Linlithgow—Linlithgow ! W. Evans.
Perth W.—Pass of Leny, Callander ! W. Evans.
Easternness—Under stones at "The Huts," Upper Glen Feshie, at an altitude of 1,250 feet, Sept. 1889 ! W. Evans.
Fife—Cambo near Crail ! W. Evans.
Banff—Tomintoul ! Lionel Hinxman.
Dumbarton—Duntocher and Garscadden, Sept. 1888 ! Alex. Shaw.
Main Argyle—Sparingly about Oban, common at Ardbhan Craigs, Aug. 1903 (Standen and Hardy, Journ. of Conch., 1883, p. 270). Isle of Lismore, Sept. 1889 ! Rev. J. E. Somerville.
Clyde Isles—Skeoch wood near Rothesay, July 1889 ! Alex. Shaw.
Sutherland E.—Golspie Burn, Brora, June 1884 ! W. Baillie.

IRELAND.

- Antrim**—Near Ushet Lough, Rathlin Island, May 1897, Lionel E. Adams.
Donegal—Not uncommon, Portsalon, May 1893, R. Standen.
Louth—Narrow Water, Dec. 1904 ! Collon, Sept. 1904 ! near Dundalk ! and Omeath ! P. H. Grierson.
Mayo E.—Lough Carra, July 1906 ! R. Ll. Praeger.
Mayo W.—In moss, dry ditch, Dugort, Achill Island, Sept. 1888 ! J. G. Milne.
Galway W.—Gentian Hill, Ballyvaughan, and Inchangoil, not plentiful, July 1890, R. Standen.
Tipperary N.—Borrisokane and Carrigahorig, Aug. 1907 ! R. A. Phillips.
Waterford—Portucally, 1907 ! P. H. Grierson.
Cork N.—Blarney, July 1907 (Welch and Stelfox, Irish Nat., Sep. 1907, p. 278).
Kerry—Killarney (R. F. Scharff, Irish Nat., July 1892, p. 67). In moss shakings, Mucksna, and Tore woods, July 1898, R. Standen.

Recorded by Westerlund, Scharff, and others as inhabiting Denmark, the South Sweden, South Norway, Mecklenburg, Brandenburg, East Prussia, Silesia, Pomerania, and the Isle of Rugen, South France, Transylvania, and Switzerland.

The sub-var. *dnubrevili* is cited by Böttger from Siders, in Valais, Switzerland, and from Montpellier, in Herault ; and by Tryon for the north of Spain.

Var. *subterranea* Bourguignat.

Zonites subterraneus Bourguignat, Amén. Malac., i., p. 194, pl. xx., ff. 13-18.
Helix botterii Parreyss in Pfeiffer, Mon. Hel. Viv., 1853, iii., p. 66.

Differs from the type in having a smaller shell, a little wider umbilicus, a thickened apertural margin, more swollen and rounded whorls, and according to Dr. Kobelt with the last markedly broader than the penultimate.

The sub-var. *botterii* is said by Dr. L. Pfeiffer to differ from the type only in its slightly more open umbilicus and the *H. etrusca* of Panlucci from the alluvium of the R. Arno is believed by Westerlund to be identical with it.

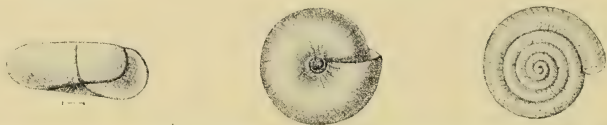


FIG. 155.—*Hyalinia botterii* Parr., showing frontal, basal, and upper aspects, $\times 6$ (after Clessin).

The sub-var. *fuerteventure* Wollaston recorded under the name of *H. secernenda* var. *fuerteventure* is said to have the umbilicus a trifle wider than the specimens found in the other islands of the group.

- Bedford**—Limbury, 1887 ! J. Saunders.
Norfolk E.—Royden Gravel pits, July 1886 ! R. T. Frere.
Norfolk W.—Narborough Clay pit, common, Sept. 1886 ! C. B. Plowright.
York Mid W.—Bolton Abbey, Sept. 1878 ! W. West.
York N.E.—Carlin How ! Saltburn wood ! and Airey Holme wood, Sept. 1886 ! W. Denison Roebuck.
York N.W.—Dovecote Gill near Sedbergh, Aug. 1887 ! W. Denison Roebuck.

Berwick—Cowdenknowes, Sept. 1886 ! W. Denison Roebuck.

Fife—Aberdour, Sept. 1886 ! Baker Hudson.

Germany—Recorded by Reinhardt from the valleys of the Spree, Uker, Oder, and Warth; from Detmold in Lippe by Borchherding; from Mecklenburg by Maltzan; from Eberbach in Baden, Ebrach in Franconia, and Wiesbaden in Nassau, by Sandberger; from Pomerania and Silesia by Reinhardt; from Bavaria by Dr. Staudinger; by S. Clessin from Alsace and Lorraine; from Kiel in Holstein, and Glücksburg in Schleswig by Friedel; while Dr. Weinland cites sub-var. *botteri* from Snabia.

Holland—Reported from Rhoon, South Holland, by Heer Schepmann.

France—Recorded from Caunterets by Dr. Fischer; and by Nevill from the base of the Peyrenère, Hautes Pyrénées; from the Haute Garonne by St. Simon; from alluvium of the Marne in Seine et Marne by Locard; above Mouxy, Aix les Bains, in Savoy, by Bourguignat; from near Fontenay-le-Comte, Vendée, by Letourneux; from the Aube by Sandberger; and as *V. botteri* from Ajaccio, Corsica, by Scharff.

Italy—Dr. Kobelt cites sub-var. *botteri* from Tuscany, and Favignana, Sicily.

Austro-Hungary—Cited by Sandberger for Carinthia; by Dr. Reinhardt from Moravia; and from Bohemia by Clessin; the sub-var. *botteri* for the island of Lesina in Dalmatia by Pfeiffer; for Ragusa and also for Croatia by Westerlund.

Greece—Dr. Böttger gives the sub-var. *botteri* for Volo, Thessaly; Demiohas and Kalamata in Morea; Westerlund cites Athens; and Dr. E. von Martens the islands of Crete and Enbea.

Sweden—Westerlund gives provinces of Blekinge, Skane, and Westergotland.

Russia—Cited by Milachevich for Sétoun near Moscow. The sub-var. *botteri* is recorded for the Crimea by Retowski.

Canary Isles—*H. secernenda* var. *fuerteventure* Wollaston found only on the Island of Fuerteventura.

Var. *eburnea* Hartmann.

Helix crystallina var. β Draparnaud, Hist. Nat., 1805, p. 118.

Helix eburnea Hartmann, Neue Alp., 1821, i., p. 231.

SHELL of a semi-opaque ivory-white.

This variety is evidently due to increased calcification of the shell substance, and must be carefully distinguished from the dull ivory-like appearance of "dead" shells, which present a similar aspect.

It is recorded for France by Draparnaud, and also noted by Hartmann.

Donegal—Port Salon, May 1893 ! R. Standen.

Var. *complanata* Jeffreys.

Zonites crystallinus var. *complanata* Jeffreys, Brit. Conch., 1862, i., p. 170.

Hyalina crystallina var. *orientalis* Kimackowitz, Beitr. Moll. Siebenb., p. 13.

SHELL nearly flat on both sides; last whorl proportionally larger than the other. The sub-v. *orientalis* is described as flatter, the whorls and aperture less round.

Somerset N.—Leigh woods near Bristol (Jeffreys, l.c.).

Lincoln N.—Louth Park near Louth, May 1887 ! H. Wallis Kew.

Austro-Hungary—Sub-var. *orientalis*, Cibensgeberge, and in the Kathrinenwalde near Hermannstadt in Transylvania (Clessin, Moll. Oesterr.-Ungarn, 1887, p. 80).

Geographical Distribution.—This species is widely distributed over the Western Palæarctic region, but its full distribution is probably uncertain, and its true range may be further concealed beneath other specific names, whose value has not yet been authoritatively examined.

H. crystallina is found quite throughout the British Isles, and there are only a few isolated districts for which its occurrence has not been verified.

GERMANY.

Widely distributed throughout the empire, its occurrence being noted in Alsace, Baden, Bavaria, Brandenburg, Bremen, Brunswick, Franconia, Lusatia, Hesse-Darmstadt, Holstein, Lippe Detmold, Merseburg, Nassau, Oldenburg, Osnabruck, Posen, Pomerania, Pyrmont, East, West and Rhenish Prussia, Saxe-Coburg, Saxony, Silesia, Snabia, Thuringia, Upper Hesse, Weimar, Westphalia, and Wurtemberg. As *H. subterranea* it is recorded from Schleswig by Friedel, from Lorraine by Clessin, and from Mecklenburg by Maltzan.

NETHERLANDS.

Holland—Reported to occur in Gelderland, Utrecht, and Zealand, by Heer Schepmann; while Dr. Jeffreys found it in the great wood between the Hague and Scheveningen in South Holland.

Belgium—Well distributed over the country, and is on record as occurring in the provinces of Antwerp, Brabant, East and West Flanders, Hainault, Limburg, Luxemburg, and Namur.



FIG. 156.—Geographical Distribution of *Hyalinia crystallina* (Müller).



Probable Range.



Recorded Distribution.

FRANCE.

It is widely dispersed throughout the country, and has been recorded as living in the following districts or departments:—Ain, Aisne, Allier, Alpes Maritimes, Aquitaine, Ardennes, Ariège, Aude, Auvergne, Basses Pyrénées, Calvados, Champagne Méridionale, Charente-Inférieure, Côte d'Or, Drôme, Finistère, Gard, Gers, Gironde, Haute Savoie, Haute Garonne, Haute Loire, Hautes Pyrénées, Hérault, Isère, Landes, Loire Inférieure, Lot-et-Garonne, Lozère, Maine-et-Loire, Manche, Meuse, Morbihan, Moselle, Nièvre, Nord, Oise, Pas-de-Calais, Puy-de-Dôme, Pyrénées Orientales, Rhône, Saône-et-Loire, Savoy, Seine, Seine-et-Marne, Seine Inférieure, Somme, Var, Vendée, Vienne, and Vosges; also as *H. subterranea* from the Aube by Sandberger, and as *V. botteri* from Corsica by Scharff.

SWITZERLAND.

Dispersed over Switzerland, and has been reported from the cantons of Aargau, Appenzell, Berne, Geneva, Glarus, Grisons, Neuchâtel, Schwyz, Valais, Vaud, and Zurich.

ITALY.

Distributed all over the peninsula and the islands, being recorded for Lombardy, Tuscany, Umbria, Rome, Campania, Emilia, Calabria, Liguria, Venetia, and from the islands of Sicily and Malta. *Hyalina cavanna* is cited from Monte Morrene in the Abruzzi by the Marchioness Paulucci.

SPAIN AND PORTUGAL.

Spain—Apparently distributed over the country, being found in Aragon, Catalonia, Old Castile, Andalusia, and the Balearic Isles. The sub-var. *botteri* is recorded from Gibraltar by Hesse.

Portugal—Said to be diffused over the whole country, but rare. It has been specially noted from Beira, Estremadura, and Minho.

Distribution of *Hyalinia crystallina* (Müll.).

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilts N.	48 Merioneth
8 Wilts S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid
21 Middlesex	HUMBER
22 Berks.	61 S.E. York
23 Oxford	62 N.E. York
24 Bucks.	63 S.W. York
ANGLIA	64 Mid W. York
25 Suffolk E.	65 N.W. York
26 Suffolk W.	TYNE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Hunts.	69 Westmorland
32 Northampton	and L. Lanes.
SEVERN	70 Cumberland
33 Gloucester E.	71 Isle of Man
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easternness
76 Renfrew	W. HIGHLANDS
77 Lanark	97 Westernness
E. LOWLANDS	98 Main Argyle
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E
87 Pth. S. & Clkn.	108 SutherlandW
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

AUSTRO-HUNGARY.

Recorded from Buda-Pesth, Trenesin, and the Carpathians in Hungary; from Austria by Schröckinger; from Peggau in Styria by Tschapeck; from Galicia by Jachno; from Goritz by Brumati; Bohemia by Slavik; Carniola by Schmidt; Carinthia by Ressmann; Croatia by Brusina; and Tyrol by Clessin. The *H. subterranea* is cited by Reinhardt for Moravia. The *H. botteri* from Dalmatia by Pfeiffer; and the *H. contracta* for Transylvania.

SCANDINAVIA.

Sweden—*H. crystallina* is said by Dr. Westerlund to be distributed over the southern and middle regions of Sweden, and is noted as occurring in the provinces of Blekinge, Halland, Nerike, Ostergotland, Skane, Smaland, and Westergotland. It is also recorded for Westmannland, Gotesborg, and around Stockholm, as well as on the islands of Oeland and Gothland. As *H. subterranea* it is recorded from Skane, Blekinge, and Westergotland.

Norway—Recorded by Esmark for Modum and Christiania in Christiania Stift, Ringerige in Hamar Stift, Vestfjorddalen in Christiansand Stift, and Stordoen in Bergen Stift. As *H. contracta* it is recorded as rare at Brevik and Lillesand in Christiansand Stift, and Bygdo, Forneboskoven, Modum, and Asker in Christiania Stift.

Denmark—According to Mr. H. Sell, it is common in the north-east part of Zealand at Klampenborg, Helsingor, etc. On Funen it is found at Halckenhavn near Nyborg, and in Jutland occurs at Strandskoven near Veyle in Aarhus, and is otherwise generally common.

BALKAN PENINSULA.

Servia—Recorded as occurring at Berg Javor and Kloster Roca (Möllendorff, Jahrb. Deutsch. Mal. Ges., 1873, p. 131).

Greece—*H. botteri* is recorded for Thessaly and Morea by Dr. O. Boettger; by Westerlund for Athens; and by von Martens for Crete and Euboea.

RUSSIA.

Recorded from Kovno, Courland, Livland, Esthland, St. Petersburg, Poland, Kursk, and Moscow. It is also reported doubtfully from Finland by Westerlund. The *V. botteri* is quoted for the Crimea by Retowski.

It is recorded also by Gerstfeldt from Siberia, but its occurrence is doubtful.

NORTH AFRICA AND ATLANTIC ISLANDS.

Algeria—Recorded for Philippeville by Morelet (Journ. de Conch., 1853, p. 283). Bourguignat records it as *Z. eustilbus* from the environs of Algiers, Philippeville, Oran, and other places.

Azores—Said to inhabit all the islands. Recorded from Horta, Fayal Island, 1890 (W. H. Rush, Nautilus, Sept. 1891). St. Michael! Furtado d'Arruda.

Canary Isles—Found on Fuerteventura and Teneriffe by Lieut.-Col. Parry, and recorded for Palma and Hierro by Mr. G. K. Gude.

Madeira—Indigenous and very common on cultivated land and elsewhere (Rev. R. B. Watson, Journ. de Conch., 1876, p. 222). Funchal, 1890-1 (W. H. Rush, l.c.). On a rock called Bugio in the Madeiran group, and from the South Desertá (Grabham, 56th Brit. Assoc. Rept., 1886, p. 696).

ETHIOPIAN REGION.

Africa—Recorded from Cape Town, Cape Colony, by Melvill and Ponsonby (Proc. Mal. Soc., Dec. 1898, p. 184).

AUSTRALASIAN REGION.

New Zealand—Recorded by H. Crosse (Journ. de Conch., 1893, p. 219).



SUB-GENUS *Euconulus* Reinhardt.***Hyalinia fulva* (Müller).**

1678 *Buccinum parvum sive Trochilus sylvaticus agri Lincolnensis* Lister, Anim. Angl., tit. ix., p. 123.

- 1774 *Helix fulva* Müller, Verm. Hist., ii., no. 249.
 1803 — *trochiformis* Mont., Test. Brit., p. 427, pl. ii., f. 9.
 1812 — *nitidula* Alten, Syst. Abhandl., pl. iv., f. 8, p. 53.
 1817 — *trochulus* Dillwyn, Descr. Catal. Shells, p. 916.
 1821 — *chersina* Say, Philad. Journ., ii., p. 156.
 1825 — *egena* Say, Journ. Acad. Nat. Sci. Philad., v., p. 120.
 1828 — *trochilus* Fleming, Brit. Anim., p. 260.
 1830 — *mortonii* Jeffreys, Linn. Trans., xvi., p. 332.
 1838 — *alderi* Jeffreys, Mag. Zool. and Bot., ii., p. 108.
 1839 — *mandralisci* Bivona, Nuov. Moll. Palermo, pl. i., f. 6, p. 16.
 1842 — *fabricii* Möller, Index Moll. Groenl., p. 7.
 1774 *Trochus terrestris* Da Costa, Brit. Conch., p. 35.
 1831 *Theba fulva* Turton's Manual, p. 99.
 1833 *Conulus fulvus* Fitzinger, Syst. Verz., p. 94.
 1837 *Polita fulva* Held, Isis, p. 916.
 1837 *Petasia trochiformis* Beck, Ind. Moll., p. 21.
 1852 *Teba fulva* Leach, Syn., p. 72.
 1862 *Zonites fulvus* Jeffreys, Brit. Conch., p. 170.
 1864 *Hyalinia fulva* Mörch, Syn. Moll. Dan., p. 11.
 1883 *Euconulus fulva* Reinhardt, SB. Ges. Naturf. Freunde, Berlin, p. 86.
 1890 *Arnouldia fulva* Bourguignat, Bull. Mal. Soc. France, p. 328.
 1890 — *gallica* Bourguignat, op. cit., p. 331.
 1891 *Vitrea (Conulus) fulva* Smith, Journ. of Conch., vi., p. 339.



Jules René Bourguignat

HISTORY.—Though Müller's description of *Helix fulva* is in part based upon the *Helix bidens* or the *Helix edentula*, both of which have the white keel and lip ascribed by the author to fully adult forms of this species, yet the description generally is pertinent to our shell, while its acceptance by Draparnaud and other authors of the period lead us to the view that it is the true species intended to be indicated by the author.

Opinions were at one time divided as to whether the *Helix trochulus* or the *Helix fulva* of Müller was the true name for the present species; the former name does not, as yet, appear to have been satisfactorily recognized, though it has been surmised that the description may have been based upon a young shell of *Buliminus obscurus*.

Hyalinia fulva is here associated with the late Jules René Bourguignat, the distinguished French conchologist, a man of marvellous industry, a keen collector and prolific writer, with remarkable powers of exact discrimination and description of conchological differences, who has especially studied the section to which this species belongs, and published a Monograph dealing with the Palearctic species of the group.

He was also the founder of the "Nouvelle Ecole," a school of thought aiming at a more critically precise limitation of species, and recognising as of specific value some of the more minute and comparative differences which are generally regarded as of only varietal importance.

The section or sub-genus *Euconulus* was instituted by Reinhardt in 1883 to supersede *Conulus*, a name which has been very generally used, but had been previously instituted by Rafinesque in 1814 for the genus *Conus*, by Nardo in 1841, and by Kuster in 1844.

The term *Trochulus* used by Dr. Westerlund has also been frequently used, notably by Humphreys in 1779.

The name *Arnouldia*, proposed by Bourguignat in 1890 for the present group, is also inadmissible, being antedated by *Euconulus*.

Euconulus is distinguished by possessing a conically pyramidal and usually horn-coloured shell of a small size, with a narrowly perforate or imperforate axis. The animal has distinct pedal grooves surrounding the foot, and the radula is characterized by a median series of tricuspidate teeth and aculeate bicuspidate marginals, while the reproductive organs, according to Von Ihering, are, as in *Microcystis* and other genera, deficient of or have only rudimentary spermatheca, although Dr. Lehmann figures and describes that organ as well developed in the present species.

According to Pilsbry, species allied to this ancient group have spread over most parts of the world. In the Palearctic region they are known chiefly as *Euconulus*; in Central and South America as *Guppya*; in India and the Orient generally they bear the names of *Sitala* and *Katiella*, while other names include species found in Polynesia.

Dr. Kobelt restricts the name *Euconulus* to *H. fulva* and its near allies, using the term *Discoconulus* for the depressed forms with narrow whorls and no keel from Eastern Asia and the West Indies, and *Trochoconulus* for the carinate, trochiform shells from Japan, etc.

Diagnosis.—The characteristically trochoid or conical aspect presented by this little shell, combined with its ill-defined and shallow umbilicus, effectually preclude its being confused with any of its congeners.

Description.—The ANIMAL is of a slaty-black colour, darker dorsally, but showing the eye retractors through the skin as two sub-parallel darker bands at each side of the dorsum; beneath the lateral groove the BODY is greyish with blackish margin to the sole; MANTLE grey with black margin, which is visible as a black edging to the aperture, as in *H. helvetica*, when the animal is crawling; OMMATOPHORES long, thick, slightly bulbous at tip, and of a translucent grey, showing the slender black retractors just beneath their upper surface; LOWER TENTACLES short; FOOT long and lanceolate in shape, projecting well beyond the shell when crawling; SOLE distinctly trifasciate, blackish in colour, with paler mid-area.

SHELL conic or pyramidal, thin, glossy, and semi-pellucid, amber coloured or horny; WHORLS 5-6, cylindrical, very slowly increasing in size, or rounded at the periphery, or may be bluntly angulated, finely but irregularly striate in the line of growth, with more or less distinct but very fine revolving lines at base; SPIRE very prominent, but the apex obtuse; SUTURE distinct and deep, base convex; UMBILICUS very small and sometimes not perceptible; APERTURE narrowly semi-lunar, peristome simple and slightly reflected at the umbilicus.



FIG. 158.

FIG. 158.—*Hyalinia (Euconulus) fulva* × 8 (after Bourguignat).

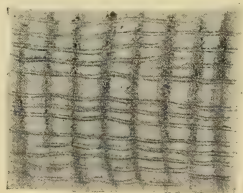


FIG. 159.

FIG. 159.—Surface sculpture of *H. fulva chersinc*, highly magnified (after Morse).

Diam., $3\frac{1}{2}$ mill.; alt., $2\frac{1}{2}$ mill.

The REPRODUCTIVE ORGANS, according to Dr. Lehmann, display a deeply pigmented OVOTESTIS, which leads by a sinuate HERMAPHRODITE DUCT to the large and linguiform ALBUMEN GLAND; the UTERUS is distinctly sacculated; and the FREE OVIDUCT is short and direct; the PENIS SHEATH is short and cylindrical, somewhat glandular, thickened below, and attenuated above, where the VAS DEFERENS enters, and the slender PENTAL RETRACTOR muscle and the short FLAGELLUM are affixed; the SPERMATHECA is globular, with a thin and fairly long stem.



FIG. 160.—Sexual organs of *H. fulva*, enlarged (after Dr. Lehmann).

The MANDIBLE or jaw is broadly crescentic and of a pale amber colour, nearly half a mill. in width from side to side, very finely granulate on the anterior face, with perpendicular though slightly diverging and delicate striæ arising from the region of the beak, which is conical and pointed and placed in the centre of the concave or cutting margin.

The outline of a subsidiary upper margin to the jaw well within the outer one and more in harmony with the form of jaw prevalent in the group is clearly perceptible, and there is no difference in the consistency or striation of the two areas.

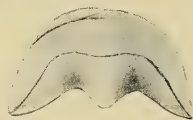


FIG. 161.—Jaw of *H. fulva* $\times 40$ (Ingleton, Mr. F. Booth) from a preparation by Prof. Gwatkin.

The LINGUAL RIBBON approximates to that of *Helix* and resembles that of *Vitrina pellucida* in the marginal teeth being all bicuspidate.

According to Dr. Lehmann, the organ is about a millimetre long and a quarter-of-a-mill. wide, with about 80–100 somewhat straight transverse rows of teeth, each row composed of about fifty-one longitudinal series. The median tooth is symmetrically tricuspidate, with a long and slender mesocone, flanked on each side by a small acutely pointed ectocone. The adjacent laterals are approximately equal in size to the median teeth, and are figured as tricuspid; the marginals though aculeate are bifid.

The formula according to Schepmann is $\frac{1}{2}^s + \frac{7}{8} + \frac{1}{2} + \frac{7}{8} + \frac{1}{2}^s$ and there are about seventy transverse rows, or a total of 3,750 teeth on the radula.

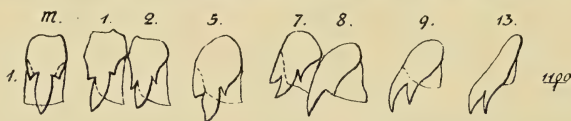


FIG. 162.—Representative denticles from a transverse row of the teeth of *Hyalinia fulva* (Müller), from Rhoon, near Rotterdam $\times 1100$ (after Schepmann).

Habits and Habitat.—*Hyalinia fulva* is a somewhat active little animal, crawling at a rapid pace, secreting an abundance of slime, and carrying its shell inclined from the perpendicular when in motion. It is a very hardy species, and can scarcely be said to hibernate, as Lindstrom has observed it in the Isle of Gothland in full activity as early as January, and according to the observations of Mr. F. Booth it may be found in the fully adult state throughout all seasons of the year.

Though inhabiting a great variety of situations, varying from the sea-level to a great height in the mountainous districts, it is chiefly found in the moister parts of shady woods, hiding beneath fallen and decaying timber and dead leaves, or amongst moss and herbage at the foot of trees and hedgerows. It also lives amongst the crevices of rocks and old walls, beneath stones in quarries, and in moist meadows, or even marshy places, submerged in times of flood and during the winter months.

In the Pyrenees it is found to a height of nearly 5,000 feet, the zone of *Helix limbata*, but in the Alps the Rev. S. Spencer Pearce has found it at an altitude of about 8,000 feet in the Grisons; Mr. E. Collier at 7,000 feet at Arolla in the Valais. In Piedmont it attains a height of over 6,000 feet, and in Tuscany about 4,000 feet, while Prof. Cockerell records its existence in Colorado at an altitude of 10,000 feet near the summit of Pike's Peak, and at Micawber Mine, in Custer co.

Geological Distribution.—PLEISTOCENE.—In South Wilts., it is listed by Mr. Kennard from the fluviatile deposits at Fisherton, near Salisbury.

In West Sussex, according to Mr. J. P. Johnson, it is present in the buried river-bed deposit on the foreshore at West Wittering.

In West Kent, it is enumerated among the list of fossils from the Ightham fissure by Mr. W. J. L. Abbott; and in East Kent is recorded by Prof. Morris from the marls about Maidstone.

In South Essex, it has been found associated with mammalian remains at Grays, Erith, and Ilford by Prof. Morris; and in North Essex has been procured from the freshwater marls of Copford and Clacton.

In East Suffolk, it has been recorded as *H. trochiformis* from the mammalian deposit at Stutton.

In Cambridge, it has been found by the Rev. E. S. Dewick and Mrs. McKenny Hughes in the gravel-pits of Grantchester and Barnwell Abbey.

In Yorkshire, it has been found with remains of extinct mammalia at Bealsbeck near Market Weighton by Mr. T. Sheppard.

In Germany, it is cited by Sandberger as rare in the Lower Pleistocene sands of Mosbach and Grotzingen in Baden, and in the tufaceous beds at Cannstadt in Thuringia. It is also found rarely in the Mid-Pleistocene beds of Grotzingen and Cannstadt, but is abundant in the alluvium of Pürklgut in Bavaria. It is also cited by Kobelt from the loess of the Rheingau in Nassau.

In Switzerland, it is cited by Sandberger on the authority of Mousson from the valley loess of St. Gall.

In Austro-Hungary, it is quoted by Sandberger as rare in the Lower and Mid-Pleistocene valley loess at Nussdorf near Vienna.

In Italy, it is recorded by Dr. Kobelt from the post-Pliocene deposits of Terra Rossa by Monte Pisano.

In North America, it has been found in the loess at Muscatine, Iowa, by Prof. F. M. Witter, and near Iowa city by Mr. H. Prime.

HOLOCENE.—In Dorset, it is cited from the tufa at Blashenwell, near Corfe Castle, by Mr. Kennard.

In South Hants., it is rare in tufa at Mottisfont, Test Valley, and very rare at Southampton Docks (J. T. Kemp, Proc. Hants. Club, 1889).

In the Isle of Wight, it is reported by Kennard and Warren from the tufa bed to the south-west of Widdick Chine, Totlands Bay.

In West Kent, it is noted by Mr. F. C. J. Spurrell in the sandy deposit on site of reservoir at the Metropolitan Southern Sewer Outfall at Crossness.

In South Essex, it has been found in the alluvium at New Park, near the White Horse, Lea Marshes, by Dr. Corner; and from alluvial peat and marl at East London Waterworks, Walthamstow, by Mr. B. B. Woodward. In North Essex, it has been found by Miller Christy in the post-glacial beds and rarely in the shell-marl, black-earth, and peat at Chignal St. James; in the alluvial shell-marl of Hostage's Farm, Felstead, by French; in drain-section in the "Marsh," near Shalford Vicarage, by Rev. A. J. Law; and by Dr. S. P. Woodward in a post-glacial deposit at Witham.

In Middlesex, it has been found by Mr. J. E. Greenhill in a deposit at Clapton, probably of the Bronze age, and is cited by Mr. Kennard from an alluvial deposit of the river Colne at Uxbridge of post-Roman age.

In Berkshire, it is reported by Mr. Kennard from beds of probably Neolithic age at Newbury.

In West Gloucester, Mr. Kennard reports it from the pre-Roman deposit of Westbury-on-Severn.

In Notts., it has been found by Gain and Musson in a black alluvium at Scarthingmoor, and also in a similar deposit at Grassthorne, Egmont.

In Yorkshire, it has been found in an old lake deposit at Askern, near Doncaster, by Dr. Corbett.

In Scotland, it has been found in Fifeshire by Mr. T. Scott, somewhat rarely in the freshwater marl at Kirkland Leven, and more commonly in the early lacustrine bed by Elie Railway Station.

In Ireland, it is quoted by Mr. Kennard from a shell-marl of uncertain age at Birr, King's co.; on a buried land surface of Neolithic age at Rosapenna in co. Donegal; and by Mr. R. Standen in the fossiliferous earthy layer, about a foot below the surface, at Dog's Bay, Galway West.

In Germany, it is recorded by Hesse from the tufa at Pyrmont; as plentiful in that at Greussen near Sonderhausen in Schwarzburg; and cited by Mr. Kennard from the calcareous tufa of Walbeck in the Harz Mountain region.

In Belgium, it is recorded by Grégoire as rare in the "Tourbe" of Uccle-lez-Bruxelles.

In France, it has been noted from the Quaternary beds of grey clay at Hérès in Haute Garonne.

In Italy, Dr. Pantanelli has reported it from the Travertine beds at Chianciano in Tuscany.

In America, it has been found in the post-glacial deposits of Michigan.

Variation.—In a restricted way, this species varies considerably in size and colour, such variations being apparently correlated with the nature of the habitat.

In damp situations, especially in open places, the shells are often inclined to be darker in colour, more glossy, and tend to grow to a larger size than the specimens found in drier places, though Dr. Jeffreys records that he has found the largest specimens in such situations.

Signor Bivona's *Helix mandralisci* from Palermo, Sicily; M. Bourguignat's *Arnouldia impropria* from Constantine and Algiers; *A. callopectica* found in Aube, Ain, and Var, and at Saragossa in Spain; *A. vespertalis* from Spain, Algeria, and near Toulouse; and *A. cavatica* from Algeria; are all probably more or less distinct varieties of the present species.



FIG. 163.

FIG. 164.

FIG. 165.

FIG. 166.

FIG. 167.

FIG. 163.—*Helix mandralisci* Bivona, frontal aspect, $\times 6$ (after Bourguignat).

FIG. 164.—*Arnouldia impropria* Bourguignat, frontal aspect, $\times 6$ (after Bourguignat).

FIG. 165.—*Arnouldia callopectica* Bourguignat, frontal aspect, $\times 6$ (after Bourguignat).

FIG. 166.—*Arnouldia vespertalis* Bourguignat, frontal aspect, $\times 6$ (after Bourguignat).

FIG. 167.—*Arnouldia cavatica* Bourguignat, frontal aspect, $\times 6$ (after Bourguignat).

Diffused throughout the Eastern United States, there exists a primitive and ancient race, which has long been considered as identical with the European *H. fulva*, and although Mr. Say, nearly a century ago, distinguished between the more ancient form *chersina* and the more modern *fulva*—the *Helix egens* of Say—yet it has been left for Mr. Pilsbry to point out clearly their distinctive characters.

The *Conulus sterkii* of Dall (Proc. U.S. Nat. Mus., 1888, p. 214) from Ohio, Louisiana, and Alabama is, according to Dr. Sterki, perhaps only a variety of *H. fulva*, the shell presenting under the microscope the same peculiar aspect; but his description of the radula as only possessing five laterals and eight marginals on each side, and all the teeth being of a tricuspid character, indicates a point of difference.

VARIATION IN SHELL.

Var. *mortonii* Jeffreys.

Helix Mortonii Jeffreys, Linn. Trans., 1830, xvi., p. 332.
Helix fulva var. *Mortonii* Gray, Turton's Manual, 1840, p. 148.
Arnouldia mortoni Bourg., Bull. Soc. Mal. Fr., 1890, p. 333, pl. 8, f. 14.

SHELL usually paler in colour; SPIRE more depressed; PERIPHERAL KEEL sharper, and upper and lower surfaces almost equally convex. Diam., $2\frac{1}{2}$ mill.; alt., $1\frac{1}{2}$ mill.



FIG. 168.—*Hyalinia mortonii* Jeffreys $\times 6$ (after Bourguignat).

This variety is figured by Reeve in his "British Land and Freshwater Shells" to illustrate his *H. fulva*.

- Devon N.**—Among wet leaves, Bideford (Turton's Manual, 1831, p. 62).
Somerset—(Jeffreys, Brit. Conch., 1862, p. 171).
Hants. S.—In woods, Abingdon Park, Winchester, May 1890! L. E. Adams.
Hants. N.—Swarraton, Rev. H. P. Fitzgerald.
Essex S.—High Beach! G. K. Gude.
Berks.—Thames rejectamenta, Maidenhead, March 1881! L. E. Adams.
Worcester—Hay Mills near Birmingham, May 1877! W. Nelson.
Derby—Robin's Wood, Repton, Rev. H. Milnes. Darleydale, 1890, J. R. Hardy.
Glamorgan—Big Wood, St. Fagan's, Cardiff, March 1885! F. W. Wotton.
Lancashire S.—Farington, June 1888! W. H. Heathcote.
Lancashire Mid—Brockholes Wood, Preston, Feb. 1889! W. H. Heathcote.
York. N.E.—Raincliffe Wood, Scarborough, C. Ashford.
York Mid W.—Shipley Glen, 1901! and Holden Gill, May 1907, Fred. Booth.
Common at Swilla Bottom, Ingleton, Sept. 1907, A. Hartley and Fred. Booth.
Antrim—In sand-drift, Whitepark Bay, May 1897, Lionel E. Adams.
Galway W.—Ballinahinch and Roundstone, Sept. 1902, J. R. le B. Tomlin.
Kilbeg, Sept. 1907 (Stelfox, Irish Nat., Dec. 1907, p. 357).

France—Recorded by Pascal from woods at Orsay, Chevreuse, Pilleux, etc., near Paris; by M. H. Cardot from the Ardennes and the Meuse; by Bourguignat from Toulouse, Haute Garonne; the banks of the Gapau river near Hyères in the Var; and near Elysée Cottin, Bagnères de Bigorre, Hautes Pyrénées.

Holland—Reported by Mr. G. K. Gude for Maestricht in province of Limburg.

Scandinavia—Enumerated by Westerlund as inhabiting Norway and Sweden.

United States—*H. fulva* var. *mortonii* has been recorded by Dr. Pilsbry as of occasional but rare occurrence in Massachusetts, New York, and Hamilton, Ontario, while Dr. Dall, who regards *H. egea* of Say as the analogue of var. *mortonii*, records it as not very rare at Cedar, Keys, and San Ferdinand, Florida.

Var. *alderi* Gray.

Helix fulva var. α *Alderi* Gray, Turton's Manual, 1840, p. 148.
Euconulus praticolus Reinhardt, Sitz-ber. Ges. Naturf. Freunde Berlin, 1883, p. 43.

SHELL smaller and darker, with distinct spiral striæ at the base.

The sub-var. *praticola* is brownish-yellow and darker than the type, and the height nearly equals the diameter; whorls rounder; aperture narrower but higher; keel obsolete; and base spirally striate. Diam. and alt., $3-3\frac{1}{2}$ mill.

- Lancashire Mid**—Hawes Water, Silverdale, J. W. Jackson.
York N.E.—*Helix alderi*, Scarborough (Greville Coll., Edinburgh Museum).
York Mid W.—Shipley Glen, 1896! and Holden Gill, May 1907, F. Booth.
Westmorland and Lake Lancs.—Near Grange, Oct. 1907! F. H. Sikes.
Cumberland—In moss, at Little Tarn, near Bassenthwaite, Capt. Farrer.
Meath—Near Trim, April 1905! P. H. Grierson.
Wicklow—Powerscourt waterfall, April 1904! P. H. Grierson.
Mayo W.—Plentiful among moss in a dry ditch at Dugort, Achill Island, Sept 1888! J. Grafton Milne.
Galway W.—"A smaller type [of the species] amongst moss on Inchangoil (R. Standen, Irish Nat., Sept. 1895, p. 267).

Germany—Sub-var. *praticola*, Loetzen, East Prussia, H. Sell.

France—Recorded by Pascal from woods near Raincy in the department of the Seine.

Italy—Sub-var. *praticola* is reported from Turin in Piedmont by Pollonera.

Scandinavia—Sub-var. *praticola* is, according to Westerlund, sporadic in moist fields in Sweden, Denmark, and the island of Gothland.

Var. *major* Moquin-Tandon.

Zonites fulvus var. *major* Moquin-Tandon, Hist. Moll., ii., 1855, p. 67.

Zonites fulvus var. *pratensis* Baudon, Nouv. Catal. Moll. Oise, 1862, p. 17.

Described by Moquin-Tandon as "shell much larger." The largest size attained by the species is given in the text as diam. 4 mill., alt. 3 mill.

The sub-var. *pratensis* has the shell of a large size, of a dull dark brown colour, and is often encrusted with dirt.

The large variety was first indicated by Férussac, Tableau Syst., p. 46.

Germany—Reported for Alsace by F. Meyer.

France—Recorded from the alluvium of the Garonne at Toulouse in Haute Garonne by Moquin-Tandon; from meadows at Cessac and Vourzac in Haute Loire and from the wood at Raincy near Paris, in the department of the Seine, by Pascal.

The sub-var. *pratensis* is recorded by Baudon from fields at Bury, Houdainville, Angy, Mouy, Beauvais and in the marshes of Merard in the department of the Oise.

Var. *alaskensis* Pilsbry.

Conulus fulvus alaskensis Pilsbry, Nautilus, Feb. 1899, p. 116.

Differs from the typical form in possessing only $4\frac{1}{2}$ whorls, the last wider than the preceding; periphery a little angulate in front, becoming well rounded; columellar insertion of the lip reflected over the perforation and nearly or quite closing it.

Alt., 2.6; diam., 3.25 mill.

The var. *fabricii* (*Helix fabricii* Möller) which, according to Tryon, is distinguished from the typical *fulva* principally by its wider body whorl, subperforate umbilicus, and more convex base, appears to differ from var. *alaskensis* only by its somewhat larger size.



FIG. 169. — *Helix fabricii* Möller $\times 4$, Greenland (after Dall).

Alaska—Recorded for Dyea Valley in south-eastern Alaska, and along the Yukon drainage from the head of Lake Lenderman to Point Romanoff and St. Michael, autumn, 1897, P. B. Randolph.

The sub-var. *fabricii* is recorded from Iceland and Greenland, also from Ungava and Labrador in **British North America**.

Var. *viridula* Taylor.

Zonites fulvus var. *viridula* Taylor, Journ. of Conch., Jan. 1883, iv., p. 28.

Hyalinia (*Conulus*) *fulva* mut. *albina* Boettger, JB.D.M.G., April 1883, p. 147.

SHELL transparent, greenish-white.

The var. *montana* of Baudon, characterized by its transparent pale fawn colour, and var. *palleszens* of Reinhardt, are probably intermediate forms connecting with the normal colouring.

Surrey—Grayswood, E. W. Swanton (C. Pannell, J. of Conch., Apr. 1903, p. 170).

Berks.—Bradfield near Reading, Rev. E. Peake.

Lincoln N.—Grisel Bottom, Burwell Wood, April 1902, C. S. Carter.

York S.W.—Near Huddersfield! J. Whitwham.

Westmorland and Lake Lancashire—Eggerslack Wood, Grange, Sept. 1908! R. Standen.

Germany—Sub-var. *palleszens* is recorded from the Riesengebirge in Silesia by Scholtz and Reinhardt.

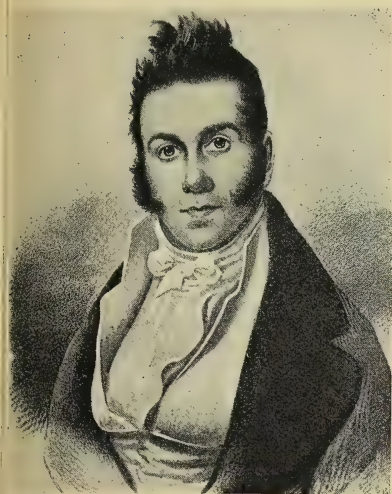
France—Sub-var. *montana* is recorded by Dr. A. Baudon as rare at Garenne d' Houdainville, Oise.

Austro-Hungary—Sub-var. *palleszens* is recorded by Reinhardt from the Upper Elbe in Bohemia.

Russia—Sub-var. *albina*, two specimens recorded by Dr. Boettger from foot of Latpari, Kutais, in Transcaucasia.

Hyalinia fulva chersina Say.

Helix chersina Say, Journ. Acad. Nat. Sci. Philad., 1821, vol. ii., p. 156.
Conulus chersinus Pilsbry, Nautilus, 1899, p. 116.



Thomas Say

THIS ancient race of *Hyalinia fulva* is dedicated with feelings of profound respect to Mr. Thomas Say, the pioneer in American conchology, and author of numerous papers upon the shells of North America, who flourished during the early part of the nineteenth century, and who even at that primitive period in conchology discriminated between the *H. fulva* and the *H. chersina*, distinguishing the former as *Helix egea*.

As distinguished from the typical *H. fulva*, *H. chersina* is described by Pilsbry as very much elevated, the height in fully-grown examples exceeding the diameter, the general form being compared to that of an immature *Cerion*; spire quite convex; whorls $6\frac{1}{2}$, narrower, more slowly increasing and more closely coiled than in *fulva*, the last only faintly angular, though carinate in young shells; the base is quite convex, and the umbilicus very narrowly open. Aperture lunate.

Diam., 2.8 mill.; alt., 3 mill.

Dr. Pilsbry, the eminent American malacologist, believes *fulva* and *chersina* to be really distinct, and although both species inhabit the Nearctic region, he hitherto has found no doubt-

ful or transitional forms among the thousands he has examined, but as this view has not yet been confirmed by the demonstration of structural differences, it has been thought best to regard *H. chersina* as an earlier or more primitive form of *H. fulva*, a view which its geographical distribution distinctly confirms, as the typical *chersina* is, according to Pilsbry, apparently restricted to the extreme southern part of the Eastern United States, being bounded on the north and west by the range of *Helix egea* of Say, which he regards as identical with the European *H. fulva*.

The JAW or mandible is small and delicate and described as arcuate, with attenuated and recurved ends, anterior surface quite smooth, with the concave cutting margin projecting in the centre and forming a rounded beak or rostrum.



FIG. 171.—Mandible or jaw of *H. chersina* (greatly enlarged) from Maine, U.S.A. (after Morse).

Mr. W. G. Binney records a considerable difference in the dentition according to the observations of different investigators. Morse gives the formula of *H. chersina* as $11+7+1+7+11$; while Binney, under the name of *H. fulva*, states the formula to be $22+8+1+8+22$. This great discrepancy would appear to indicate that different forms were under examination.



FIG. 172.



FIG. 173.

FIG. 172.—Mid-tooth, with representative lateral and marginal teeth of *Hyalinia fulva* Binney (highly magnified) from Orono, Maine (after W. G. Binney). Formula $22+8+1+8+22$.

FIG. 173.—Half a transverse row of the teeth of *H. chersina* Morse (highly magnified) from Maine, U.S.A. (after Morse). Formula $8+7+1+7+8$.

The range of the true *H. chersina* has not yet been definitely ascertained, but in one or other of its forms it has been demonstrated to exist in the province of Ontario in British North America, and in Alabama, Arkansas, Carolina North

and South, Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Nebraska, New Hampshire, New York, Ohio, Pennsylvania, Rhode Island, Tennessee, Texas, Vermont, and Virginia.

In its strictly typical form, Dr. Pilsbry informs me it is confined to Florida and the low country from North Carolina to Alabama, but is not found in the Southern Allegheny Mountains, nor on the southern extremity of Florida.

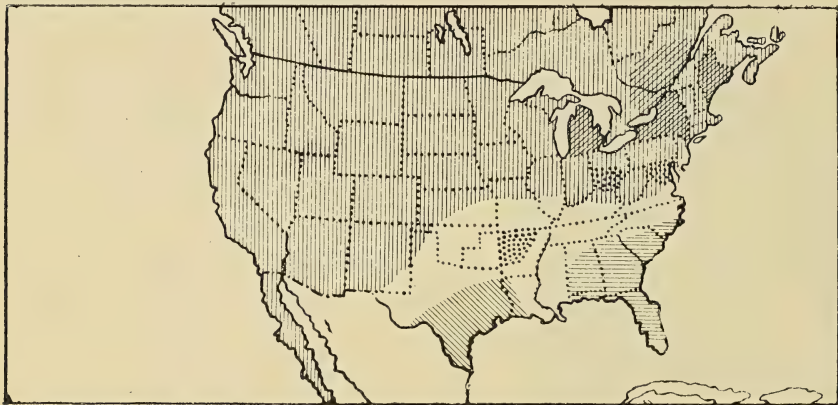


FIG. 174.—Map illustrating the Geographical Distribution in the United States of *Hyalinia fulva* and its more striking forms, prepared by Dr. Pilsbry, and based on the Collections of the Academy of Natural Sciences, Philadelphia.



H. fulva.



H. chersina.



var. *polygyrata.*



var. *trochula.*



var. *dentata.*

Alabama—(H. A. Pilsbry).

Georgia—The type specimens were described from the Sea Islands by Mr. Say (H. A. Pilsbry, *Nautilus*, 1899, p. 116).

Florida—Volusia county (H. A. Pilsbry, *Nautilus*, loc. cit.).

North Carolina—Smoky Mountain (Walker and Pilsbry, *Proc. Acad. Nat. Sci. Philad.*, 1902).

South Carolina—(H. A. Pilsbry).

Var. *polygyrata* Pilsbry.

Conulus chersinus polygyratus Pilsbry, *Nautilus*, Feb. 1899, p. 116.

Described as of a deep brownish-amber colour, and as similar to sub-var. *trochulus*, but less elevated, with narrower aperture; whorls over six, very narrow, the last bluntly but decidedly angular in front above the middle of the whorl, which causes a peculiar sloping below the periphery; upper surface with a silky lustre; base glossy with a silky band around the outer margin.

Diam. 3 mill., alt. 2.2 mill., but sometimes found even larger.

Said to differ from typical *chersinus* and *trochulus* in the peculiar form of the base and the narrower and less transverse aperture, due to the high position of the peripheral keel. The more convex dome-shaped spire and more numerous whorls are very characteristic when once recognized.

Dr. Pilsbry says this variety is very close to *chersina*, and when larger series are obtained from Illinois, South Indiana, West Kentucky, and Tennessee, it will probably intergrade in characters, and is almost sure to connect in geographical range.

It has been reported from:—

Alabama—Where it has been collected by Mr. H. H. Smith (G. H. Clapp).

Indiana—(H. A. Pilsbry).

Illinois—Algonquin (G. H. Clapp).

Iowa—Ruthven (G. H. Clapp).

- Kentucky**—(H. A. Pilsbry).
Maine—Orono, and a very fragile form at Kennebunkport, in company with *H. fulva*, and about equally common (G. H. Clapp).
Massachusetts—Amherst (G. H. Clapp).
Michigan—Not as common as typical *fulva*, but ranging widely over the state, and has been noted by Mr. B. Walker from nineteen of the eighty-four counties into which the state is divided.
Minnesota—White Earth Lake and Thief River Falls (G. H. Clapp).
Nebraska—Omaha, Roca, and Monroe Canyon, Sioux co. (G. H. Clapp).
New Hampshire—(G. H. Clapp).
New York—Litchfield and Westchester co. (G. H. Clapp).
Ohio—Cincinnati (G. H. Clapp).
Pennsylvania—Edgeworth (G. H. Clapp).
Rhode Island—(H. A. Pilsbry).
Tennessee—(H. A. Pilsbry).
Vermont—Hartland (G. H. Clapp).

In **British North America** it is recorded from Ottawa, Hamilton, Lake Rousseau, and Georgian Bay in Ontario.

Var. *trochula* Reinhardt.

Euconulus trochulus Reinhardt, SB. Ges. Naturf. Freunde Berlin, 1883, p. 43.
Conulus chersinus trochulus Pilsbry, Nautilus, 1899, p. 116.

Described as resembling *chersina*, but as paler in colour, less elevated (though still high) and the crescentic aperture narrower. Diam. 2.8 mill.; alt. 2.75 mill.

Though near *chersina* this form, which links the true *chersina* with *fulva*, is said to be not difficult to distinguish, and may form a south-western racial group.

Louisiana—On the north-west of the state (H. A. Pilsbry).

Texas—Very abundant, New Braunfels (Pilsbry, Naut., Feb. 1899, p. 116).

Var. *dentata* Sterki.

Conulus fulvus var. *dentata* Sterki, Nautilus, May 1893, p. 45.
Conulus chersinus dentatus Pilsbry, Nautilus, Feb. 1899, p. 117.

Described as possessing at somewhat irregular intervals on the inner base of the last whorl a series of small and white, radially-disposed testaceous deposits, each with one to three prominences or teeth of exactly the same character as those of *Gastrodonta lamellidens*, and visible outwardly as white radiate markings, and possibly constituting defensive barriers.

This peculiar armature of the mouth is practically restricted to young and adolescent individuals, and has been viewed as a character in process of acquirement by the species, tending also to bring it into harmony with the prevalence of similar structures existing amongst many diverse species living in the regions where it has been found.

A consideration of the subject, however, leads to the view that this peculiarity is not nascent, but vestigial, and the survival of an ancient characteristic; which is rendered probable not merely by the finding of this form only in the primitive regions of North America, but by the transient development of this structure in young shells and its disappearance in adult life, thus recalling the recapitulation theory of the embryologists; and the corroborative evidence of its living in Alabama in the less favourable hilly districts, while in the valleys the specimens exhibited no trace of this calcification, either in old or young shells.

A parallel phenomenon exists in *Pupa umbilicata* or *cylindracea*, which exhibits in the young state a similar series of calcified radial processes, all of which disappear before the maturity of the shell.

According to Pilsbry, it is a very rare form, and occurs sporadically.

Alabama—In many localities, Jackson co.; H. E. Sargent (Sterki, Naut., l.c.).

Arkansas—Logan co. (H. A. Pilsbry).

Columbia—Washington, E. Lehnert.

Ohio—In several localities around Cincinnati (Doherty, Quart. Journ. of Conch., 1878, i., p. 344).

Virginia—(G. H. Clapp).

Geographical Distribution.—*H. fulva* has an enormous range, being widely disseminated throughout the boreal and temperate areas of the Holarctic region, and has been introduced into Australasia.

It is widely dispersed throughout the British Isles, and though probably existing in every division, has never been recorded for the Hebrides or the Shetland Isles.



FIG. 175.—Geographical Distribution of *Hyalinia fulva* (Müller).

▨ Probable Range.

■ Recorded Distribution.

In its typical form it extends over Europe and the northern parts of Asia, its range extending northwards well within the Arctic Circle, while in the south it extends into North Africa, and in Asia as far as Cashmere, and eastward to the extreme confines of the continent and Japan.

In the New World the real equivalent of the present species, according to Pilsbry, is the *Helix egna* of Say, which was described from examples found in the suburbs of Philadelphia, and is widely dispersed over Canada, the northern half of the United States and along the whole Pacific coast of North America, as far as Tepec in South California, and appearing in Texas in an intermediate form, linking the type with the *H. chersina* of Say, which still occupies the south-eastern states.

In the Rocky Mountains and California it is chiefly confined to the elevated regions, and is apparently absent from the intervening arid ground, the specimens seem nearly typical *fulva*, although somewhat diverging forms are present.

According to Sandberger, specimens in his collection from the alpine districts are loftier in the spire and of lesser diameter than those from the plains, conforming in this respect with the more primitive American form *H. chersina*, and Herr Clessin records the same peculiarity in the examples from Kutais in Transcaucasia.

GERMANY.

Recorded by various observers from Alsace, Baden, Bavaria, Brandenburg, Bremen, Brunswick, Darmstadt, Franconia, Hanover, Hesse, Hesse-Cassel, Holstein, Lippe, Lorraine, Lusatia, Mecklenburg, Merseburg, Nassau, Oldenburg, Osnabrück, Pomerania, Posen, East, West and Rhenish Prussia, Reuss, Saxony, Silesia, Suabia, Thuringia, Vogtland, Weimar, Westphalia, Wurtemberg, and the Isle of Rugen.

NETHERLANDS.

Belgium—Recorded for the provinces of Brabant, Hainault, Liège, Limburg, Luxemburg, and Namur.

Holland—In South Holland it is recorded by Dr. Gwyn Jeffreys from the great wood between the Haghe and Scheveningen, and by Schepmann from Rhoon, as well as from North Holland; from Maestricht and Fauquemont in Limburg by Ubachs; and by Van den Broeck from Exaerde in Zealand.

FRANCE.

Distributed throughout France, and has been especially recorded as existing in Ain, Aisne, Allier, Alpes Maritimes, Alsace, Aquitaine, Ardennes, Ariège, Aube, Auvergne, Bouches du Rhône, Calvados, Champagne Méridionale, Charente Inférieure, Côte d'Or, Drôme, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Hautes Pyrénées, Haute Savoie, Hérault, Isère, Loire Inférieure, Lozère, Manche, Maine et Loire, Meurthe et Moselle, Meuse, Nièvre, Nord, Oise, Pyrénées Orientales, Puy de Dôme, Rhône, Saône et Loire, Savoy, Seine, Seine et Marne, Seine et Oise, Somme, Var, Vendée, and the Island of Corsica.

ITALY.

This species is cited as existing in Calabria, Emilia, Lombardy, Piedmont, Tuscany, and the Islands of Sardinia and Sicily.

SWITZERLAND.

Reported as occurring in the cantons of Aargau, Appenzell, Basle, Berne, Glarus, Grisons, Lucerne, Neuchâtel, St. Gall, Solothurn, Unterwalden, Uri, Valais, and Vaud.

AUSTRO-HUNGARY.

This species is found in Austria; at Carlsbad and other places in Bohemia; in the sub-alpine regions of the Sudetic Mountains in Moravia; in the Tyrol; about Cracow and other places in Galicia; in South and North Croatia; at Monfalcone in Goritz; at Tarvis and Villach in Carinthia; at Buda Pesth, Trencsin, Tatra Mountains and Lake Balaton in Hungary; and in Transylvania.

SPAIN AND PORTUGAL.

Spain—Recorded for Catalonia, Teruel, Aragon, Valencia and the Balearic Isles.

Portugal—Cited by Morelet as inhabiting moist fields in Alentejo.

SCANDINAVIA.

Norway—Found over the whole country, and is the commonest species in Arctic Norway, being sometimes present when no other mollusk is found.

Sweden—Extends over the whole country from Lulea Lappmark southwards, and has been especially recorded for Warmland, Gothenborg, Westernorrland, and the Island of Gothland.

Denmark—This species is found in Jutland, at Frederiksdal near Lyngby in Zealand, and the Islands of Funen and Bornholm.

Reported by Mörch for the west coast of Iceland and the Faroes.

BALKAN PENINSULA.

Recorded from Montenegro; from Zara in Dalmatia; from Sinaja in Moldavia; Tomos Pass in Wallachia; from Nemila in Bosnia; and from the Morea in Greece.

RUSSIA.

H. fulva is widely distributed throughout the Russian Empire, and its occurrence has been noted in Courland, Crimea, Esthland, Finland, Kaluga, Kiev, Kharkov, Kuba, Kursk, Lapland, Livland, Moscow, Olonetz, Poland, Perm, St. Petersburg, and Tambov; also the Kuban and Terek territories of Ciscaucasia; and Armenia, Baku, Elizabetpol, Kars, Kutais, Suanetien, Mingrelia, and Tiflis, in Transcaucasia.

MEDITERRANEAN SUB-REGION.

Asia Minor—*H. fulva* is cited for Samsun in Trebizond, from Armenia, and from Adana in Cilicia.

Persia—Recorded from Mazanderan by Mr. Blanford.

Algeria—*H. impropria* Bourgt. is reported from Constantine and Algiers; *H. vespertilis* from the banks of the Harrach near Algiers; and *H. cavatica* from Algiers, Constantine, and Philippeville.

ATLANTIC ISLES.

Azores—Recorded for the Azores by Fischer (Journ. de Conch., 1876, p. 76).

SIBERIAN SUB-REGION.

Siberia—*H. fulva* is recorded by Dr. Westerlund as extending over all Siberia, from the Urals to Kamschatka, and has been specially recorded by Gerstfeldt for Kurgan in Tobolsk; and by Westerlund for many localities in the Yenissei Valley up to Dudine, 69° 15' north latitude. It has also been found in the Altai region in Tomsk; in the vicinity of Irkutsk, and Baikal Lake, and is enumerated for the basin of the river Lena by Dall and others. Westerlund and Maack have found it in Amurland, and Mousson records it from Primorsk at Khabarovka at the junction of the Ussuri and Amur rivers; Westerlund from Nikolaevsk at the mouth of the Amur; Dall from Commander Isles, and Pooten, Konyam, and St. Lawrence Bays in East Siberia; and Middendorff from Petropavlovsk in Kamschatka.

In Eastern Turkestan it was found by Nevill at Yarkand, and in Tarim by Andreae.

In Chinese Turkestan it was reported by Andreae from the province of Kan-su and also from North-East Tibet.

In Ferghana it was found by Fedtschenko at Khokand, and is also recorded from Iskander Kul, as well as from the region east of the Aral sea in Syr Daria.

From the Pamirs it is reported from Wakhan by Nevill.

In Cashmere it is reported from Ladak; by F. Stoliczka from Lahul; and by Theobald from drift at an altitude of 6,000 to 7,000 feet at Spiti.



FIG. 176.—Map of the Geographical Distribution of the aggregate form of *Hyalinia fulva* (Müller).



Probable Range.



Recorded Distribution.

MONGOLIAN SUB-REGION.

China—Recorded from Pekin in the province of Pe-chi-li by Deshayes, and from the summit of Pochwshan at an altitude of near 8,000 feet by Moellendorff.

Japan—Recorded by Schrenk from North Japan.

Primorsk—Vladivostok (Mousson, Journ. de Conch., 1887, p. 13).

NEARCTIC REGION.

Greenland—Reported as var. *fabricii* by Dr. Dall.

BRITISH NORTH AMERICA.

In its aggregate form *H. fulva* has been recorded from almost every district of British North America and the United States.

Alberta—Reported from Laggan, Red Deer, Olds and McLeod by Dr. Dall; and from Banff by Mr. Stewardson Brown.

British Columbia—Recorded from Field in the Canadian Rockies by Stewardson Brown; and by Rev. G. W. Taylor from Victoria, Vancouver Island.

Keewatin—English river (Dall, Moll. Alaska, 1906, p. 41).

Labrador—Var. *fabricii* reported by Dr. Dall.

Mackenzie—Collected about Great Slave Lake by Kennicott.

Manitoba—Reported by Mr. Hanham as locally plentiful at Winnipeg, but according to Dr. Sterki "different to usual form." Also recorded by Miller Christy as pretty common in moist spots by sloughs about Carberry; at Pine Creek; by the Lake of the Woods; and on Pembina Mountain.

New Brunswick—Banks of St. John river, Andover (E. W. Roper).

Ontario—St. Thomas (D. B. Cockerell); very common about Ottawa, the largest specimens in a very wet station north of Fairy Lake.

Quebec—Anticosti (Litchford); and by Hanham in the Gaspé region, and as fairly abundant about Quebec.

Ungava—*Z. (C.) chersina* var. *egena*, Ungava Bay (Dall).

Yukon—Recorded from Klondyke by Mr. G. H. Clapp.

UNITED STATES.

Alaska—Sitka, Unalaska, Behring and Aleutian Islands (Dall).

Arkansas—Conway, Crawford and Franklin counties (Sampson).

Alabama—Scarce on "benches," Cumberland Mountains, Jackson co. (Sargent).

Arizona—Logan (H. Prime).

California—Lake Tahoe, alt. 7,000 ft. (Cooper); Cuernamaca Mts., San Diego co. (Dunn); and Bluff Lake, San Bernardino co. (Berry).

North Carolina—Foot of Mount Mitchell, Buncombe co. (Andrews); Roan Mts. (Walker and Pilsbry).

South Carolina—*H. fulva chersina* (Pilsbry).

Colorado—Black Lake Creek and Dillon, Summit co., alt. 8,850 feet; Swift Creek, alt. 8,200 feet, and West Cliff, Custer co.; Egeria, Routh co.; Box Elder, Larimer co.; Eldora, alt. 8,540 feet, Gregory Canyon, and Copeland Park, Boulder co.; Eldorado, Springs co.; Bluebird, Mine co.; Buzzard's Creek, Mesa co.; Divide Creek, Garfield co.; Surface Creek, Delta co.; Kremmling, Grand co.; also in Empire, Chaffee, and Pueblo counties (Cockerell).

Columbia—Sub-var. *dentata*, Washington, E. Lelmert.

North Dakota—Ten miles below Fort Berthold (Binney); Little Missouri, Oct. 1882 (Krause).

Florida—Cedar Keys, Levy co., rare (Hinkley); Fernandina (Hemphill); Archer, Alachua co. (Dall); Miami, rare, Jan. 1899 (Rhoads).

Georgia—*H. chersina* found by Mr. Say on the Sea Islands.

Illinois—Rockford, Winnebago, rare (Hinkley); Tescar, Lee co. and Mercer co., rare (Marsh); Canton (H. Prime); shores of Lake Calumet, near Chicago (Baker).

Indiana—Franklin co., plentiful (Moore and Butler); Connersville, Fayette co., common (Reynolds); Henry co. (Pleas).

Iowa—Muscatine, somewhat rare (Whittier); Davenport, rare (Platt); Iowa city (H. Prime).

Kansas—Thayer (Ferris).

Kentucky—Coalport (B. Walker).

Louisiana—Sub-var. *trochula* (Pilsbry).

Maine—Diffused throughout the state; very large specimens at Fort Kent (Morse); Orono (Binney); Bethel (Roper); Cross Lake, Aroostook co. (Nylander); Westbrook (Rev. E. C. Bolles).

Massachusetts—Dartmouth and Westport (Thomson); abundant, Fresh Pond, Cambridge (Ritchie); Revere, common (Roper); Amherst (B. Walker).

Michigan—Reported by Mr. Bryant Walker as found in twenty-four of the eighty-four counties into which the state is divided.

Minnesota—Near Belle Isle and Clearwater Lake, on islands in Mississippi at Clearwater, and at Rockford, Wright co., abundant (Sargent).

Missouri—Sedalia and Lamar (Sampson).

Montana—Fort Benton (H. Prime); Mingusville (Squyer); Missoula, June 1897 (Elrod).

Nebraska—Common in the state (Aughey).

New Hampshire—Francestown (Roper).

New Jersey—(G. H. Clapp).

New Mexico—Chicorico Canyon near Ratou, alt. 7,000 feet, in region of *Quercus gambeli* and *Robinia neomexicana*, Aug. 1900 (Cockerell); Sacramento Mountains at Cloudercroft, alt. 9,500 feet, in Canadian zone, Otero co., May 1902 (Vanatta).

New York—Mohawk Valley, Herkimer co. (Lewis); Yates co. (Hart Wright); banks of Owaseo river, Hayden's Mills, Auburn, April 1882 (Baker); Cayuga Lake Valley, common (Banks); Pittsford, Monroe co. (Walton); Plattsburgh, not common (Hudson).

Nevada—White Pine (H. Prime); east slope of Sierra Nevada (Call).

Ohio—Cincinnati (Byrnes); Toledo (Roper); Garrettsville (Luther); Kent (Dean); and Columbus, Franklin co. (Moores).

Pennsylvania—Blairsville (Harn); Allegheny co. (Stupakoff); Germantown (Tryon); *H. egea* was described from specimens found ten miles above Philadelphia.

Rhode Island—Tiverton (Thomson).

Tennessee—Sewanee (H. Prime); Knoxville, Knox co., and Roan Mt. Station, Carter co., rare (Andrews).

Texas—Currys Creek (H. Prime); Navarro co. (B. Walker).

Utah—Salt Lake City (Call); American Fork Canyon, Wahsatch Mountains; and Summit Canyon, Mount Nebo (Putnam); universally distributed throughout the mountain ranges of the great central basin (Hemphill).

Vermont—Not rare (Gould).

Virginia—Sub-var. *dentata* (G. H. Clapp).

Washington—Seattle, King co. (Randolph).

CENTRAL AMERICA.

Mexico—Tepec, south of Mazatlan in Lower California (J. G. Cooper).



FIG. 177.—Helks Wood, Ingleton, Yorkshire, where *Hyalinia fulva* is fine and plentiful.

Distribution of *Hyalinia fulva* (Müll.).

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilts N.	48 Merioneth
8 Wilts S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid.
21 Middlesex	HUMBER
22 Berks.	61 S. E. York
23 Oxford	62 N. E. York
24 Bucks.	63 S. W. York
ANGLIA	64 Mid. W. York
25 Suffolk E.	65 N. W. York
26 Suffolk W.	TYNE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Hants.	69 Westmorland
32 Northampton	and L. Lancs.
SEVERN	70 Cumberland
33 Gloucester E.	71 Isle of Man
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkeudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easterness
76 Renfrew	97 Westerness
77 Lanark	98 Main Argyle
E. LOWLANDS	99 Dumbarton
78 Peebles	100 Clyde Isles
79 Selkirk	101 Canfire
80 Roxburgh	102 Ebudes S.
81 Berwick	103 Ebudes Mid
82 Haddington	104 Ebudes N.
83 Edinburgh	N. HIGHLANDS
84 Linlithgow	105 Ross W.
E. HIGHLANDS	106 Ross E.
85 Fife & Kinross	107 Sutherland E.
86 Stirling	108 Sutherland W.
87 Pth. S. & Clkn.	109 Caithness
88 Mid Perth	NORTH ISLES
89 Perth N.	110 Hebrides
90 Forfar	111 Orkneys
91 Kincardine	112 Shetlands
92 Aberdeen S.	

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

Probable Range.



Recorded Distribution.



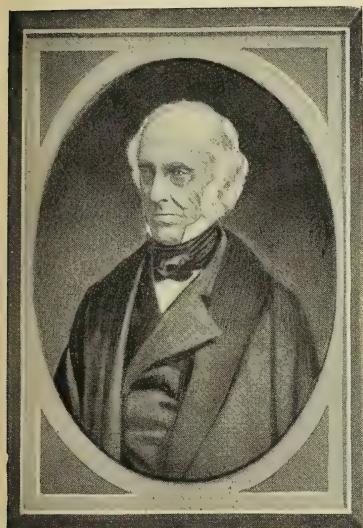
Distribution verified by the Author.



Geological Distribution.

GENUS *ZONITOIDES* Lehmann.*Zonitoides excavatus* (Bean).

- 1830 *Helix excavata* Bean, Trans. N.H. Soc. Northumb., i., p. 38.
 1830 — *nitida* var. *a* Jeffreys, Linn. Trans., xvi., pp. 399 and 511.
 1857 — *lucida* var., Turton's Man., p. 175, pl. xii., f. 138.
 1840 *Zonites excavatus* Gray's Turton's Manual, p. 57, pl. iv., f. 39.
 1871 *Hyalina* (*Euhyalina*) *excavata* Kobelt, Catal. Eur. Binnenconch., p. 5.
 1877 *Hyalinia excavata* Westerlund, Faun. Eur. Extran., p. 26.
 1891 *Vitrea* (*Zonitoides*) *excavata* Smith, Journ. of Conch., vi., p. 339.



William Bean

HISTORY.—*Zonitoides excavatus* (*excavata*, hollowed out) is one of the few species first detected in the British Isles, and as yet has only been found in few localities beyond our limits, although this may really be due to a lack of co-ordination in the British and continental knowledge.

This species is dedicated to its discoverer and describer, Alderman William Bean, of Scarborough, who by his exceptionally keen perceptive and discriminatory powers discovered many additions to the British molluscan fauna.

The genus *Zonitoides* was established by Dr. Lehmann, of Stettin, for the reception of *Hyalinia nitida*, which he demonstrated to differ from the rest of the European *Hyaliniae* in possessing a well-developed dart-sac, containing a simple curved calcareous dart.

The group is further characterized by its depressed or subdiscoidal, widely umbilicated SHELL with obliquely lunate aperture.

INTERNALLY, the JAW is broadly crescentic with rounded ends, the lower or cutting margin with a noticeable protuberance or beak, and the upper margin bearing a somewhat corresponding depression.

The REPRODUCTIVE ORGANS show several primitive characteristics, which are paralleled by similar structures amongst the peculiar genera inhabiting the Malayan region.

They possess a STYLOPHORE or dart-sac, bearing near the distal end a conspicuous projecting gland, named by Dr. Pilsbry the CORONAL GLAND, which in the far east is represented in certain species by a circlet of glands encircling the sac; the DART is a simple, curved, and slightly-twisted crystalline weapon, which, though exactly analogous to the Helicine dart, is not regarded as its homologue, but as a distinct structure, and has, therefore, been named *Pugio* by von Ihering to emphasize its independent origin in this group.

A further peculiarity is the bifurcate stem to the SPERMATHECA DUCT, one branch debouching at the base of the FREE OVIDUCT and the other into a cul-de-sac surrounding the PENIS, etc.

One of the most remarkable structures in the group is the peculiar calcareous CHANNLED PLATE within the penis sheath, quite analogous to that found in *Cochlicella acuta*, and whose function is as yet quite unknown.

Diagnosis.—Resembles its congener, *Z. nitidus*, but differs in the greater convexity of the shell above and beneath, and especially by its very wide umbilicus; the whorls are also more rounded and more closely coiled, and the last not so large in proportion to the rest; the striae also are rather stronger.

INTERNALLY, it displays as a noticeable and distinctive feature the whiteness of the arterial system, due presumably to lime, as in *Arion*. The ramifications of the vessels, especially of the hepatic artery, are as distinct as in *Arion ater*, and the abrupt termination of the smaller branches is just as striking.

Description.—ANIMAL with a slender BODY, very pale slate or whitish with a bluish-grey tinge towards the HEAD, very rarely black, with the usual dorsal furrows; TAIL narrow and keeled, and not reaching to the margin of the shell when crawling; FOOT-SOLE trifasciate, the central area slightly darker than the pale bluish-grey side areas; MANTLE closely covered with white specklings; TENTACLES somewhat long, only slightly bulbous at the extremity, the black ocular points showing up very distinctly on the white surroundings; when the tentacles are withdrawn the eye-specks are distinctly visible beneath the skin; lower tentacles short; LOCOMOTORY MUCUS not very copious, thin, and slightly iridescent.

INTERNALLY, the SUPRA-ÆSOPHAGEAL ganglia are large and white, the components are closely approximate but connected by commissures; the GANGLIA are as usual largest on the right side of the body; the SUB-ÆSOPHAGEAL ganglia are greyish; the OTOCYSTS on the posterior face of the pedal ganglia showing up white against the grey mass; the HEART is of a lenticular shape, constituted by a transparent pearly-white auricle and a pale-grey ventricle of nearly equal size and of similar pyriform shape, joined together by a slender neck, the ventricle fitting into the auricle like a ball into a socket, the whole enclosed within a thin and transparent pericardium; the KIDNEY is greenish-grey in colour with fine anastomosing lines.

The ALIMENTARY SYSTEM is composed of a long and slender ÆSOPHAGUS, upon which the SALIVARY GLANDS rest; these are usually distinct, but sometimes blend together, and have long dark grey ducts; the CROP is somewhat oval in shape, yellowish-brown in colour and imbedded in the digestive gland or liver, which is of a deep-brown, upon which the opaque-white branches of the hepatic artery are very conspicuous and striking.

The MUSCULAR SYSTEM as displayed by the BUCCAL RETRACTORS is such as in the typical *Hyalinia cellaria*; the PHARYNGEAL and paired TENTACULAR RETRACTORS each arise from a distinct and separate point of the great columellar muscle; the pharyngeal retractor, which is very broad and is only slightly cleft before its junction with the buccal bulb, tapers gradually to its origin on the upper surface of the columellar muscle; the right and left tentacular retractors originate from the corresponding right and left margins of the columellar muscle, giving off slender branches to the lower tentacles.

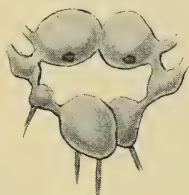


FIG. 179.

FIG. 179.—Subesophageal ganglia of *Zonitoides excavatus*, showing otocysts on lower face of pedal centres, $\times 10$.

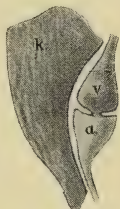


FIG. 180.

FIG. 180.—Renal organ or kidney and heart of *Z. excavatus*, $\times 10$.
k. kidney; a. auricle; v. ventricle.

colour with fine anastomosing lines.

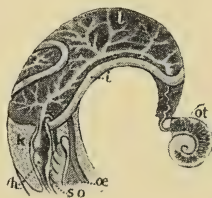


FIG. 181.

FIG. 181.—Underside of Penultimate and Superior whorls of *Zonitoides excavatus*, showing arrangement of the organs, $\times 6$.
ot. ovotestis; l. liver; i. intestine; k. kidney; h. heart; œ. œsophagus; s.o. spermatheca and oviduct.



FIG. 182.

FIG. 182.—Buccal retractors of *Z. excavatus*, $\times 10$.

The REPRODUCTIVE ORGANS exhibit an OVOTESTIS which is imbedded in the digestive gland and placed within the apex of the spire; the HERMAPHRODITE DUCT is slightly sinuate, thick and white in mid-course, and leading to the minute VESICULA SEMINALIS; ALBUMEN GLAND elongate, of a clear slate or lilac colour, but sometimes greyish-yellow; OVIDUCT sacculate, varying in colour from a light-slate to dark-grey; FREE OVIDUCT not so long as dart-sac, but surrounded and concealed by an oval glandular mass of a greenish-yellow colour; SPERM DUCT or prostate not closely attached to oviduct, enlarging at base to a white spongy

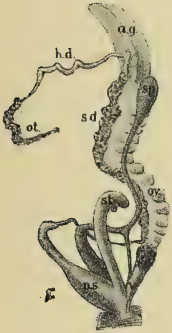


FIG. 183.



FIG. 184.



FIG. 185.



FIG. 186.

FIG. 183.—Reproductive organs of *Zonitoides excavatus*, $\times 3$, showing the arrangement of its constituent parts.

ot. ovotestis; h.d. hermaphrodite duct; a.g. albumen gland; s.d. sperm duct; p.s. penis sheath; ov. oviduct; v. vagina with vaginal gland; sp. spermatheca with bifid duct; st. stylophore or dart sac.

FIG. 184.—Proximal portion of sexual organs of *Zonitoides excavatus*, $\times 10$ (from a photograph by Mr. W. Moss) showing the position and character of the calcareous penial plates, the dart, the coronal gland, and the bifid spermathecal duct.

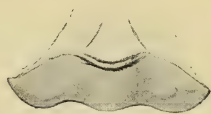
st. stylophore or dart sac showing natural position of dart and coronal gland, c.gl.; p.s. penis sheath with the channeled plates; vag. vagina; sp. bifid spermatheca duct.

FIG. 185.—Upper, lower, and end view of the calcareous penial plate of *Zonitoides excavatus* (after micro-photograph by Mr. W. Moss).

FIG. 186.—Gypsobelum or Love-dart, showing side and front aspect, $\times 10$, and an enlarged view of the head of the dart.

matter; SPERMATHECA small and pyriform, of a yellow colour, with a brownish nucleus, attached to and imbedded in the upper part of the ovispermatoduct; the stem is grey, very long, and bifurcate proximally; one branch is slender and opens into the free oviduct, its junction being concealed by the vaginal glands; the other enlarging below joins the penis-sheath near the opening into the atrium, but, according to Prof. Pelseneer, does not really open into the penis, but into a closed sac or space surrounding the penis and dart-sac; the PENIS-SHEATH is dilated and thick below, slender above, passing into the VAS DEFERENS, and interiorly possesses the calcareous channeled sheath analogous to that of *Cochlicella acuta*, but whose function is unknown; the DART SAC is long, with a curved free distal end, and bearing a pendant coronal gland beneath the curve; the DART is an exquisite and delicate little weapon, and long for the size of the animal, the shaft round and slightly twisted, expanding at the base, the apex or free-end slightly compressed and dilated; the degree of twist is variable, but usually forms an arc of about 60 degrees.

The MANDIBLE or jaw is strongly arcuate and somewhat crescentic in shape, of an amber colour, with delicate wavy striation or sculpture, which runs parallel with the upper and lower margins; the extremities are distinctly rounded below and slightly recurved above; the upper margin is distinctly incurved in the centre, and the lower or cutting margin displays a median, somewhat bluntly projecting beak or rostrum, making the lower and upper margins almost parallel; the elasma is wide and distinct with many longitudinal striæ.

FIG. 187.—Mandible or jaw of *Zonitoides excavatus*, $\times 10$.

The LINGUAL MEMBRANE is of the usual oblong shape, and somewhat recalls that of *Hyalinia nitidula*, but has nine bifid laterals instead of four, as in that species. It still more closely resembles that of its close ally *Zonitoides nitidus*, but the teeth are rather narrower.

The radula bears about eighty obliquely curved rows of teeth, each row composed of a rather broad median tricuspid tooth; the mesocone and ectocones being sturdy and strong; the bifid laterals show a very broad and strong mesocone, with a well-developed and conical ectocone, while the marginals are of the simple aculeate pattern.

The formula of the species is usually $\frac{1}{1} + \frac{9}{2} + \frac{1}{3} + \frac{9}{2} + \frac{1}{1} \times 80 = 4,080$.

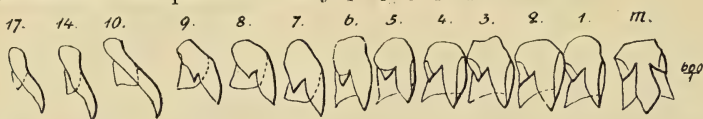


FIG. 188.—Representative denticles from a transverse row of the teeth of *Zonitoides excavatus* (Bean), from England, supplied by Dr. Jeffreys, $\times 600$ (after Schepmann).

Reproduction and Development.—No details are known of the congress of this species, but the act evidently takes place early in the year, as loosely agglutinated clusters of four to six slightly ovate eggs have been found in the beginning of March, while adults have been found often containing darts as late as the middle of May, but after that period darts were absent from mature specimens, which became more uncommon and the immature specimens more plentiful.

Food and Habits.—*Zonitoides excavatus* is a local and sometimes an abundant species, often living in company with *Helix rotundata*. It is a species with no especial predilection for a limestone soil, while in the north of England it is most plentiful on the Coal Measures. It hides beneath dead and decaying leaves and fallen timber in woods or hedgerows, and though a truly geophilous species, has been observed climbing the stems of "Bracken" (*Pteris aquilina*) and even living among *Iris* in moist hollows in company with *Z. nitidus*.

Though often found abroad on the milder days of winter, it buries itself during the more severe weather six or eight inches deep within the fibrous earth below the layer of dead leaves, forming a delicate epiphragm.

Mr. F. Taylor has remarked on its predilection in Lancashire for the runs of field mice, and believes they feed upon the mice droppings.

In Ireland, Mr. R. Welch has observed that it is rarer in Kerry on the Carboniferous Limestone than on the Old Red Sandstone, and that its habitat is almost invariably in or on the margins of the ancient woods, or in the damp little glens, mostly near the coast, with their old native scrub, often the only remnant in a district of the primitive forests of Ireland, destroyed since Elizabethan times when the country was largely forest. It is never found in new woods or in cultivated areas unless they adjoin some old rough ground or primitive woodland.

Geological Distribution.—PLEISTOCENE.—Recorded by Prof. R. Tate as found fossilized in the freshwater marls of Copford, Clacton, etc., in North Essex.

In East Suffolk, it is recorded by Prof. Morris from the freshwater deposits of Stutton, on the authority of Mr. Searles V. Wood.

HOLOCENE.—Found by Mr. R. M. Christy in the deposits by the river Cann, at Chignal St. James, in North Essex.

Variation.—The only modification hitherto noted of this species is the crystalline variety, which is linked with the type by the very pale yellow form.

VARIATION IN SHELL.

Var. *vitrina* Jeffreys, Brit. Conch., 1862, p. 168.

Zonites excavatus var. *hyalina* Jeffreys, Ann. Nat. Hist., 1858, p. 47 (nomen nudum).

SHELL greenish-white and semi-transparent.

The distribution of this variety is somewhat erratic, and would appear to indicate the environment as a potent predisposing factor in its production. Mr. F. Taylor remarks that in Holden Clough, near Oldham, the type abounds, and none of the variety have been found, whereas a short distance away the variety is equally common with the type.

ENGLAND AND WALES.

Devon S.—Plentiful in one spot, Erme Woods (E. D. Marquand, J. of Conch., Oct. 1899, p. 138). Ivy Bridge, W. Webster.

Devon N.—New Bridge, near Barnstaple ! F. J. Partridge.

Somerset S.—Dulverton, 1903 ! Hugh Watson.

Dorset—Morden ! E. Ruthven Sykes.

Hants. S.—An intermediate transparent pale yellow form numerous in a small copse on Roeshot Hill, Christchurch, type apparently absent, Oct. 1885 ! C. Ashford.

Bucks.—Burnham Beeches, G. D. H. Carpenter.

Warwick—At foot of a poplar in a damp meadow between Knowle and Packwood, Sept. 1874 ! W. G. Blatch. Sutton Coldfield, with type, 1899, Guy Breeden.

Pembroke—Narberth, May 1885 ! Charles G. Barrett.

Cardigan—Borth, Aug. 1907, A. H. Jowett-Murray.

Merioneth—Dolgelly, July 1886 ! F. G. Fenn. Fairbourne, where the variety far outnumbered the type, Aug. 1907, A. H. Jowett-Murray.

Carmarthen—Var. *hyalina*, Trosserch Wood (J. G. Jeffreys, l.c.).

Cheshire—Marple, Sept. 1885 ! T. Rogers. Marston Forge, Northwich, Oct. 1885 ! C. Oldham. Owley Wood and Marbury, B. R. Lucas. Disley, K. H. Jones. Eastham, 1885 ! E. Collier. Butt's Clough and Rostherne (Milne and Oldham, J. of C., Jan. 1894, p. 318). A bleak hillside, opposite Parkgate railway station, F. Taylor.

Lancashire S.—Drinkwater Park, near Prestwich, 1884, E. Collier. Hough End ! Thomas Rogers. Warrington and Agecroft near Manchester ! G. Jackson. Bardsley near Oldham, with type, F. Taylor.

Lancashire Mid—Crystalline specimens in British Museum, labelled "Preston."

York S.W.—Golear Wood ! J. Whitwham. Hey Wood near Honley, more plentiful than the type, March 1875, J. Conacher. Bullecliffe Wood ! G. Taylor.

Durham—Gibside Woods ! J. Alder.

Cumberland—Common in the Lake district, Bassenthwaite, etc., W. J. Farrer.

IRELAND.

Donegal—Wood at Ardara, 1900 ! R. Welch.

Dublin—Dublin, W. White Walpole.

Mayo W.—Delphi, with type, April 1897, R. Welch.

Galway W.—Connemara (Jeffreys' Brit. Conch., 1862, p. 169).

Waterford—Common in wood, Glendine, July 1907 ! W. Denison Roebuck.

Cork N.—With type, Lough Allua, July 1907 ! R. A. Phillips.

Cork S.—Schull (Phillips' Cork List, 1894). Glengariff, 1891 ! R. F. Scharff.

Kerry—Cloonee, with type (Dr. Chaster). Elsewhere the var. is the most prevalent form, and is especially abundant at Mucksna Wood in Kenmare demesne, and at Inchiquin (R. Standen, Irish Nat., Sept. 1898, p. 220). Derrynane, 1892 ! R. F. Scharff. Common with type in woods at Glengariff ; and on Torc Mountain, July 1907 (Stelfox and Milne, Irish Nat., Sept. 1907, p. 288).

Geographical Distribution.—*Zonitoides excavatus* is a species that has probably been misunderstood and overlooked on the continent, as it is very unlikely to be so strictly confined to the limits of the British Isles, as its recorded distribution would indicate.

The only extra-British localities known up to the present time are Esschen near Antwerp, Belgium, from whence it is recorded by M. Colbeau, and the vicinity of Flensburg in Schleswig.

In the British Isles it is somewhat sporadically distributed over England, Ireland, and Scotland, but has not yet been authenticated for East Anglia.

ENGLAND AND WALES.

PENINSULA.

Cornwall W.—Hayle, April 1884 ! Miss S. Hockin. Near Land's End, Aug. 1883, E. D. Marquand. Abundant among dead leaves in woods, Camborne (J. P. Johnson, Geol. Mag., 1903, p. 27).

CHANNEL.

Dorset—Enumerated for Weymouth (Damon, Geol. Dorset, 1884, p. 234). East Lulworth, J. C. Mansel-Pleydell. Parkstone, Aug. 1904 ! Hugh Wyndham.

Isle of Wight—Apse woods and among damp leaves, etc., Alverstoke (Venables Guide to Isle of Wight, 1860, p. 462). Sandown (R. Tate, Brit. Moll., 1866, p. 109).

Hants. S.—Generally distributed in the New Forest, and in some woods, as Wilverley, it is very common (E. D. Marquand, Sci. Goss., June 1879, p. 125). Rather common on Hengistbury Head, June 1883 ; Scott's Hill Meadows, under bark of trees with *Balea perversa*, Nov. 1891, J. H. Ashford. Wootton End ; Hoborne ; Boscombe ; Holmsley ! and Cluton Bunny, Barton Cliffs ! C. Ashford.

Sussex W.—Midhurst, Sept. 1881 ! W. Jefferys. Under dead fir bark, St. Leonard's Forest, Mr. Borrer (J. E. Harting, Zool., March 1878, p. 88).

Sussex E.—Streamside, Rowfant, Tilgate Forest, E. Saunders. Heathfield, T. Harding. Peplie, Horsted Keynes, Aug. 1900 ! W. Whitwell.

THAMES.

Kent W.—Tunbridge Wells, Dr. J. G. Jeffreys.

Surrey—Common, Barnes, April 1885 ! Mrs. Skilton. Headley lane (E. H. Rowe, Garner, 1886, p. 19). Garden, Manor Park House, Sutton, Nov. 1902, F. H. Sikes. Mortlake and Epsom, E. Step (C. Pannell, jun., J. of Conch., 1902, p. 170).

Herts.—Sandridge, Dec. 1883 ! A. F. Griffiths.

Berks.—Wellington College, and near Bucklebury fish-ponds, Oct. 1906, Rev. E. Peake.

Oxford—Rejctamenta of Thames, Port Meadow, Oxford, 1871 ! W. Whitwell.

ANGLIA.

Suffolk W.—Recorded for Hardwick by Rev. Carleton Greene.

Northampton—Garden, Woodend, July 1881, A. Loydell. Thorpe village, frequent, July 1882, A. W. Nichols.

SEVERN.

Gloucester E.—Wooton, near Gloucester (Tate, Brit. Moll., 1866, p. 109).

Warwick—Sutton (H. Overton, Journ. of Mal., Sept. 1900, p. 171).

Stafford—Cannock road, near Stafford, May 1886 ! Lionel E. Adams. Basford, near Leek, and byrth Hill, Maer, J. R. B. Masefield. Oakamoor, A. T. Daniel.

SOUTH WALES.

Glamorgan—Gellygron, near Swansea, Dr. J. G. Jeffreys.

Pembroke—Hoyle's Mouth, near Tenby, C. Jefferys.

Cardigan—Lane off Aberystwyth road, Borth, Aug. 1907 ! A. H. Jowett-Murray.

NORTH WALES.

Merioneth—Tan-y-bwlch, Dr. J. G. Jeffreys. Bwlch-y-Coedlwydd and Pandora's Well, Barmouth, Aug. 1884 ! J. Hopkinson.

Carnarvon—Llanberis, Dr. J. G. Jeffreys.

TRENT.

Lincoln N.—Woodhall Spa, F. W. Fierke.

Leicester—In willow stumps below Castle Mount, Benscliff Wood (J. Plant, Leicestershire List, 1887, p. 28).

Notts.—Very rare, Attenborough bogs (Dodd and Musson, Notts. List, 1881). Near Sawley (Lowe, Conch. Notts., 1853). Clifton, B. Sturges Dodd. Sherwood Forest, J. Ray Hardy.

Derby—Robin's Wood near Repton, Rev. H. Milnes. Burton-on-Trent, P. B. Mason. Foremark ! J. T. Marshall. Plantations by Peak Forest Canal, July 1891. Miller's Dale, Thomas Hey. Moderately common, Clifton ; and road-side between Winster and Ashbourne, Aug. 1889 ! Lionel E. Adams.

MERSEY.

Cheshire—Near Heatley, Sept. 1882, L. E. Adams. Common along Baguley road, Sale ; and Gib lane, Northenden, 1885 ! C. Oldham. Baguley and Eastham, June 1888 ! E. Collier. Not uncommon about Ashley, Hale, Rostherne, Dunham, Sinderland and Wythenshawe (Milne and Oldham, J. of Conch., Jan. 1894, p. 318). Bidston (Rev. H. H. Higgins, Liverpool List, 1891, p. 23).

Lancashire S.—On the Cheshire border, near Manchester, the type and variety are not uncommon, L. E. Adams. Abundant, Barlow Wood ; Hough End Clough (J. Hardy, Manchester List, 1865, p. 37). A large colony on canal bank, opposite Buckley's Mill, Reddish ; and roadside, by waterworks, Prestwich, Apl. 1880 ! L. E. Adams. Clifton Junction, Sept. 1885 ! Thos. Rogers. Roadside between Ormskirk and Halsall ; and at base of Parbold Beacon, Dr. G. W. Chaster. Holden Clough, Sept. 1902 ! and abundant at Bardsley, near Oldham, Fred. Taylor. Rare near

Whalley, F. C. Long. Rainhill (Rev. H. H. Higgins, Liverpool List, 1891, p. 23).
Turton, near Bolton, fairly plentiful (J. W. Baldwin, J. of C., Oct. 1903, p. 367).
Southport, J. W. Williams.

Lancashire Mid—Specimens in British Museum, Sept. 1886, labelled "Preston."
In wood, Halton near Lancaster, Feb. 1888 ! R. Standen. Grisedale near Scorton ;
and Dolphinholme near Lancaster (J. Davy Dean J. of Conch., Jan. 1907, p. 12).

York S.E.—Forge Valley near Scarborough. H. T. Soppitt.

York N.E.—Thomasson Foss, Whitby, Sep. 1904, W. E. Brady. Hayburn Wyke,
Aug. 1894, Tom Petch.

York S.W.—Wood near Winterset (C. Ashford, Ackworth List, Zool., 1854).
Common on decaying fir stumps, Wheatley Wood, Doncaster (Corbett, Naturalist,
June 1902, p. 206). Notton near Barnsley, Oct. 1903, W. E. Brady. Spring Wood,
Elland Wood, Bollam, and Park Wood, Elland ! J. E. Crowther. Brighouse (Nat.,
Dec. 1875, p. 74). Common, Bullecliffe Wood, near Wakefield, Dec. 1876 ! Haw
Park ! J. Hebden. Hagg Wood, Mirfield, March 1902 ! T. Castle. In wood behind
Quakers' Meeting House, Dewsbury, W. E. Brown. Golear Wood, near Hudders-
field ! W. Nelson. Hey Wood, near Honley, March 1875, J. Conacher. Roydhouse
Wood, April 1876, Lister Peace. Bramley Fall Wood, Dec. 1870 ! Thomas Rhodes.
Newholme Dean, April 1885 ! W. West. Nab Wood, Shipley, Sept. 1887, J. A.
Hargreaves. Common in Calverley Wood, 1887, F. Rhodes.

York Mid W.—Sunny Bank, Pannal, May 1885 ! and Guy's Cliffe Wood,
Pateley, Sept. 1882 ! W. Denison Roebuck. Ripley Woods, 1887 ! F. R. Fitzgerald.
Dob Park Wood, Washburndale, July 1883 ! W. Denison Roebuck. Bolton Woods,
1889 ! amongst pines in Fell Wood, Barden Tower, Sept. 1904 ! not common about
York, but found in Nova Scotia Wood (R. M. Christy, Zoologist, 1881, p. 244).
Hawkesworth Wood, Horsforth, April 1884 ! head of Waterloo Lake, Roundhay
Park, June 1883 ! and in bog, Meanwood Valley, April 1885 ! W. D. Roebuck.
Fagley Woods, March 1887 ! H. T. Soppitt. Shipley Glen, 1886 ! J. W. Carter.
Slate quarry, by Beazley Beck, Ingleton, Sept. 1908, R. Standen.

York N.W.—Wensley, Sept. 1885, W. Webster.

TYNE.

Durham—Stella Dean, where it was first observed by Rev. Wm. Mark ; also in
Gibside Woods (whence we have got a white variety) ; and in one or two of the
adjoining deans, but sparingly (J. Alder, Northumb. and Durh. List, 1848, p. 129).
Great High Wood, near Durham, Aug. 1887 ! B. Hudson.

Northumberland—Newcastle (Lowe, Conch. Notts., 1853).

Cheviotland—Very rare, Hulne Woods, Alnwick (G. R. Tate, Proc. Berw. Club,
1858, p. 113).

LAKES.

Westmorland and Lake Lancashire—Ambleside, Jan. 1908 ! F. Hawkesworth.
Coniston, Apr. 1887 ! S. C. Cockerell. Wood near Holker, Sept. 1908, J. W. Jackson.

Cumberland—In moss, but not plentiful, in Corby, Gelt and Wreay Woods
(Miss Donald's List, 1882, p. 57) ; near Scalehill, Lorton, June 1907 ! W. J. Farrer.
Gowbarrow Park (J. Davy Dean, J. of Conch., Jan. 1907, p. 12).

SCOTLAND.

WEST LOWLANDS.

Kirkcudbright—Kippford, Dalbeattie, Jan. 1907 ! Rev. R. Godfrey.

Wigtown—Galloway, J. G. Jeffreys. Knockglass, near Stranraer ! W. Evans.

Ayr—"Wild Cat Road," Seamill, Nov. 1903 ! and Portincross, Feb. 1904 ! Rev.
R. Godfrey.

Renfrew—Shielhill Glen, and Cloch near Greenock, Feb. 1886 ! Thomas Scott.

EAST LOWLANDS.

Linlithgow—East bank of river Avon, July 1901 ! Rev. R. Godfrey.

EAST HIGHLANDS.

Stirling—Cumbernauld Glen ! (Flora and Fauna of W. of Scotland, 1876, p. 41).

Perth S. and Clackmannan—Strathrye near Callander ! W. Evans.

Mid Perth—Achtoo by Lochearnhead, Sept. 1902 ! W. Evans.

Aberdeen S.—Aberdeen, Dr. J. G. Jeffreys.

WEST HIGHLANDS.

Main Argyle—Loch Awe station, June 1900 ; Glen Sheilach, Dunollie, Glen
Crutten and Kilniver, July 1901, Rev. R. Godfrey.

Clyde Isles—Isle of Cumbrae, 1854 ! Rev. Dr. Norman. Skeoch Woods, Rothe-
say, Bute, Sept. 1887 ! Alex. Shaw.

Cantire—Common at Ronachan, Jan. 1906 ! Rev. R. Godfrey. "White Shore,"
rather scarce (Scott, Journ. of Conch., v., p. 76, July 1886).

NORTH HIGHLANDS.

Ross W.—Balmacarra, Aug. 1906 ! Rev. R. Godfrey.

IRELAND.

ULSTER.

Donegal—In wood, Ardara, April 1900, R. Welch. Abundant in Ray, Kilderry and Walworth Woods, July 1903 ! J. N. Milne. Very sparingly at Dunlewy ; and in woods at Glenveagh (Stelfox, Irish Nat., March 1906, p. 64).

Fermanagh—Under pine-bark in the demesne of Tempo Manor, R. F. Scharff.

CONNAUGHT.

Mayo W.—Type and variety, Delphi Pass, April 1897, R. Welch.

Galway W.—Clifden (R. Tate, Brit. Moll., 1866, p. 109). Roundstone and Renvyle, March 1891, R. F. Scharff. Gentian Hill, July 1905, W. F. de V. Kane. Dernasluggan, April 1897, R. Welch.

Galway E.—Woodford, Aug. 1907 ! R. A. Phillips.

MUNSTER.

Clare—Glens near Ennistymon and Moy, March 1902, P. H. Grierson.

Limerick—Limerick, Dec. 1886 ! Dr. W. H. Evans.

Tipperary S.—Canonwood near Clonmel, Rev. A. H. Delap.

Waterford—Laurel Bridge in Morgan's Glen, near Clonmel, June 1886 ! Rev. A. H. Delap. Near Youghal, Aug. 1902, P. H. Grierson.

Cork N.—Mallow and Killeagh, P. H. Grierson. Carrigrohane, Aug. 1907 ! R. A. Phillips. Lough Allua, with variety, July 1907 ! R. A. Phillips.

Cork S.—Found at Dunscombe Wood near Cork by Miss King (J. D. Humphreys, Fauna and Flora of Cork, 1845, p. 4). Castle Berehaven, May 1893 ; Glengariff, May 1891, R. F. Scharff. Near Macroom, June 1903 ; Killeagh, 1902, P. H. Grierson. Rare, Mount Desert (Humphreys). Rochestown and Schull (R. A. Phillips, Cork List, Sept. 1894).

Kerry—Muckcross, Sept. 1885 ! J. Ray Hardy. Valentia Island and Ballycarberry, April 1888, Rev. A. H. Delap. Killarney, May 1891 ; and Derrynane, July 1892, R. F. Scharff. Very common in Mucksna Wood, Kenmare, Sep. 1898, L. E. Adams. Type and variety, Cloonee, Dr. Geo. W. Chaster. Roughty Bridge, Sheen Falls, Galway's Bridge, etc., May 1898, R. Welch.

GERMANY.

Recorded by Dr. Westerlund from Flensburg in Schleswig.

NETHERLANDS.

Belgium—A single specimen found by M. Jules Colbeau in May 1865, in the province of Antwerp, at Esschen, in a moist hedge-side ditch on the road to Calmpthout.



FIG. 189.—Bramley Fall Wood, near Leeds, one of the sanctuaries of *Zonitoides excavatus* (Photo. by Mr. R. Mackay).

Distribution of *Zonitoides excavatus* (Bean).

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilt N.	48 Merioneth
8 Wilt S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid
21 Middlesex	HUMBER
22 Berks.	61 S.E. York
23 Oxford	62 N.E. York
24 Bucks.	63 S.W. York
ANGLIA	64 Mid W. York
25 Suffolk E.	65 N.W. York
26 Suffolk W.	TYNE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Hunts.	69 Westmorland
32 Northampton	and L. Lanes.
SEVERN	70 Cumberland
33 Gloucester E.	71 Isle of Man
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	95 Aberdeen N.
73 Kirkcudbright	96 Banff
74 Wigtown	97 Elgin
75 Ayr	98 Easternness
76 Renfrew	W. HIGHLANDS
77 Lanark	97 Westerfless
E. LOWLANDS	98 Main Argyle
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E
87 Pth. S. & Clkn.	108 Sutherland W
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

- Probable Range.
- Recorded Distribution.
- Distribution verified by the Author.
- Geological Distribution.

Zonitoides nitidus (Müller).

- 1774 *Helix nitida* Müller, Verm. Hist., ii., p. 32, no. 234.
 1789 — *nitens* Gmelin, Syst. Nat., p. 3633.
 1789 — *succinea* Studer, Faun. Helvet. in Cox's Travels, iii., p. 249.
 1801 — *nitida* Draparnaud, Tabl. Moll., p. 96.
 1805 — *lucida* Draparnaud, Hist. Moll., p. 103, pl. viii., ff. 11, 12.
 1826 *Helicella nitida* Risso, Hist. Nat. Eur. Merid., iv., p. 72.
 1837 — *succinea* Beck, Index Moll., p. 7.
 1858 — *lucida* Bellars, Ill. Cat. Br. L. & F. W. Shells, p. 16, pl. 2, f. 38.
 1833 *Oxychilus lucidus* Fitzinger, Syst. Verz., p. 100.
 1834 *Tanychlamys lucida* Benson, Proc. Zool. Soc., p. 89.
 1837 *Polita lucida* Held, Isis, p. 916.
 1840 *Zonites lucidus* Gray's Turton, p. 174, pl. 4, f. 38.
 1853 — *nitidus* Lowe, Moll. Notts., p. 69, ff. 43, 44.
 1855 — (*Aplostoma*) *nitidus* Moquin-Tandon, ii., p. 72, pl. vii., ff. 11-15.
 1871 *Hyalina (Euhyalina) nitida* Kobelt, Catal. Eur. Binnenconch., p. 5.
 1877 *Hyalina nitida* Westerlund, Faun. Eur. Moll., p. 26.
 1873 *Zonitoides nitidus* Lehmann, Moll. Pommern, p. 72, pl. x., f. 23.



HISTORY.—This species was first described by Müller in 1774, and in 1801 Prof. Draparnaud in his "Tableau" recognised it as a French species, and adopted Müller's name; but in the "History," published during 1805, after his death, great confusion has been caused by the name being purposely or accidentally transposed with that of *Hyalina lucida*.

It is the *Helix hydrophila* of Ingalls, the *Helix tenuis* of Dillwyn, and according to Tryon the *H. nitescens* of Andz.

With this species is associated Mr. W. Moss, of Ashton-under-Lyne, who is not only an able conchologist, but a skilful anatomist, and an accomplished adapter of the photographic camera and microscope to the needs of the study.

He first detected the presence of the calcareous penial plates in *Zonitoides*,

and has elucidated and confirmed many important anatomical details in the present and other species.

Diagnosis.—*Zonitoides nitidus* may be distinguished from its congener *Z. excavatus* by its narrower umbilicus and its rich deep-brown colouring. From *Hyalina nitidula* it differs in the total absence of the white basal opacity, greater convexity, and darker colour. From *H. radiatula* it differs in its much larger size, but is more difficult to separate when young; it is, however, more globose, has fewer whorls, and the striation is more markedly irregular.

INTERNALLY, the lime-charged arterial vessels, especially of the hepatic region, which form such striking and beautiful tracery upon the darkly-coloured external surface of that organ in *Zonitoides excavatus*, are in the present species scarcely apparent.

Description—ANIMAL with a long, slender, and very lubricous BODY, of an almost uniform deep slaty blue-black colour; DORSAL FURROWS distinct, and enclosing a row of broad and well-defined tubercles; the tubercles of the body generally are large, flat, and indistinct, dusted over with whitish specks, and broken up by several longitudinal, somewhat divaricating furrows on each side of the dorsal line; MANTLE grey, finely spotted with black; TENTACLES granulate, long and somewhat slender when fully extended; EYE SPECKS black; lower tentacles very short and swollen at ends.

SHELL convexly rounded above, flatter beneath, of an almost uniform bright reddish-brown colour, without any whitish basal opacity, very glossy, with strong and numerous transverse striæ which are stronger and somewhat puckered at the suture; WHORLS five, convex, the last noticeably wider than those preceding; SPIRE raised; SUTURE deep; APERTURE forming about three-fourths of a circle; OUTER LIP thin, and only very slightly reflected around the deep, moderately-wide and funnel-shaped UMBILICUS which exposes all the interior of the spire.

Diam., 8 mill. ; alt., 4 mill.

When containing the living animal, the shell presents an uniformly dark chocolate-brown appearance with a duplex darker margin to the aperture.

INTERNALLY, the NERVE RING consists of large and white SUPRA-ÆSOPHAGEAL GANGLIA, closely approximate but connected by commissure; the PEDAL GANGLIA are greyish and fused together, the OTOCYSTS showing up as white specks on their posterior face; the VISCERAL LOOP contains the typical five components, the ABDOMINAL GANGLION being the largest, and fused with the right pallial centre, which is noticeably larger than its fellow on the left side, an unfailing indication of dextral organization.



FIG. 191.—Renal organ and heart of *Z. nitidus* $\times 10$
a. auricle;
v. ventricle
k. kidney.

The REPRODUCTIVE SYSTEM shows an elongate OVOTESTIS with compact acini, and the HERMAPHRODITE DUCT is somewhat sinuous in its course; the ALBUMEN GLAND is linguiform, formed of closely appressed lobules, and of a clear brown or yellowish-grey colour, with minute milk-white specks; this gland is as usual only slightly developed in the young, but acquires considerable dimensions in adults, especially at pairing time; the VESICULA SEMINALIS or claw is oblong and greyish-brown in colour; OVIDUCT or uterus light grey and distinctly sacculate; FREE OVIDUCT direct and stout, with a greenish glandular investment; the PENIS SHEATH is dilated and bulky basally, and contains a calcareous channel-shaped organ with a distinct rim or collar at one end, whose function is unknown, but which only exists in conjunction with the dart; distally the penis sheath abruptly contracts, and probably constitutes an EPIPHALLUS, from whose free end the VAS DEFERENS and RETRACTOR MUSCLE arise; SPERMATHECA pyriform and yellowish with a long and slender stem which divides below, the most direct and slender branch enters the base of the free oviduct, the other and larger

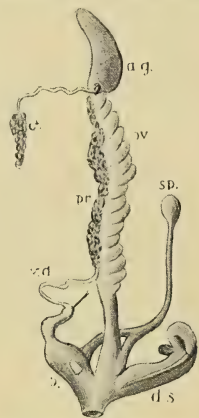


FIG. 193.—Sexual organs of *Z. nitidus* $\times 3$, showing the arrangement of the organs and the position and character of the dart and dart-sac, the calcareous penial channel, etc.

a.g. albumen gland; d.s. dart sac, showing dart and subapical coronal gland; ov. oviduct; ps. penis sheath, showing position of calcareous collar; pr. prostate; sp. spermatheca, showing the bifurcate stem; v.d. vas deferens.



FIG. 192.—Gypsobelum or dart of *Z. nitidus* $\times 10$, side view and front view.

delicately curved filiform weapon, of a glistening white colour, without blades or annulus, and is described by Dr. Lehmann as possessing an expanded base and somewhat lanceolate head, as in *Z. excavatus*, but I have not been fortunate to find one answering that description.

The ALIMENTARY SYSTEM shows a long, slender, and black ŒSOPHAGUS, with SALIVARY GLANDS on each side, but not united above, with long dark grey ducts; the somewhat ovate yellowish-brown CROP is imbedded in the dark-brown LIVER or digestive gland, upon which the opaque white ramifications of the hepatic artery due, presumably, to lime, as in *Arion*, and quite as conspicuous, while the abrupt terminations of the smaller branches are just as striking.

The MANDIBLE or jaw is arcuate, and of the usual crescentic shape, of a deep amber colour, with several strongly marked longitudinal lines, parallel with the undulating upper margin; the upper margin shows a slight indentation in the centre, and distinctly recurved ends, the lower margin shows a distinct median beak or rostrum, from which the outline forms a bold curve to the angle of the upper margin; behind there extends a distinct but almost transparent elasma.

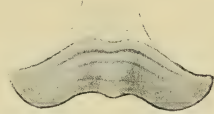


FIG. 194.—Jaw or mandible of *Zonitoides nitidus* $\times 10$.
Marfield, Tipperary, Rev.
A. H. Delap.

The LINGUAL RIBBON is of the usual oblong shape, about one-and-a-half mill. long and a half mill. wide, and formed of about eighty transverse series of teeth in obliquely curved rows, each row composed of a symmetrical median tooth with a long and powerful mesocone and a strong ectocone at each side; the laterals are nine in number, and bicuspidate, the mesocone being flanked by a broad and sturdy ectocone; the marginals are, according to Schepmann, about eighteen in number and simply aculeate, gradually diminishing in size at the margins of the membrane.

The formula of a Dutch specimen from Rhoon, near Rotterdam, is given by Schepmann as $\frac{1}{2}^8 + \frac{2}{2} + \frac{1}{2} + \frac{2}{2} + \frac{1}{2}^8$, and the number of transverse rows being about eighty gives a total of 4,400 teeth for the species.

Mr. W. G. Binney gives the formula of an American specimen, sent by Dr. Showalter, from Baldwin co., Alabama, U.S.A., as $\frac{2}{2}^0 + \frac{5}{2} + \frac{1}{2} + \frac{5}{2} + \frac{2}{2}^0$.

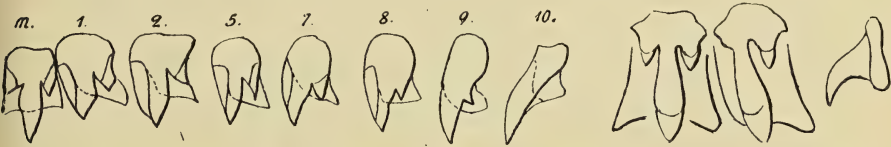


FIG. 195.

FIG. 195.—Representative denticles from a transverse row of the teeth of *Zonitoides nitidus* (Müller), from Rhoon near Rotterdam $\times 600$ (after Schepmann).

FIG. 196.

FIG. 196.—Representative median, lateral, and marginal teeth of *Zonitoides nitidus*, from Baldwin co., Alabama, highly magnified (after W. G. Binney).

Reproduction and Development.—Little is known of the details of reproduction and development, but congress probably takes place early in the year, as many loosely agglutinated egg clusters have been found at the beginning of March, and young of only two millimetres diameter have been observed at the end of August, while half-grown shells are most numerous in early December.

That the period of congress is probably early in the year may be inferred from the fact that specimens examined up to and including May were usually furnished with the gypsobelum or love dart, while those examined in the later months were almost invariably deficient of this weapon.

The eggs are sub-globular in shape, and possess a firm opaque-white shell; they vary in size from $1\frac{1}{4}$ to $1\frac{1}{2}$ mill. in length and are about a millimetre broad.

They are deposited singly or in small loosely agglutinated clusters, of four to six eggs each, chiefly during spring and early summer, but the period may extend to September, the total number of eggs varying from thirty to fifty; they are said to hatch in fifteen or sixteen days, the young snail becoming adult in about fourteen months.

Food and Habits.—*Zonitoides nitidus* is a somewhat gregarious species, not very active in habit, and bearing its shell at an angle varying between 40° and 70° from the horizontal line; it inhabits moist places, amongst moss, roots of grass, and other herbage, especially at the margins of canals, muddy streams, ditches, rivers, and marshy places generally, frequently in association with *Agriolimax leviss* and *Succinea*. According to the observations of Mr. F. Rhodes, it is found chiefly amongst aquatic grasses, growing along the water-courses, being particularly partial to *Glyceria aquatica*, and where this grass is common, the shell frequently abounds.

It is said to be common, and even sometimes in profusion, in pine-beds and damp hothouses, where it is very destructive, but it is not improbable that in many cases the shells thus named are really *H. alliaria*.

Though crepuscular or nocturnal in habit, they will emerge from their hiding-places during or after rain, and crawl about during the day over the wet mud and the leaves and stems of the rushes, sedges, iris, and other aquatic plants.

It would appear to be quite amphibious, and can endure complete submersion for a lengthened period; Wattebled stating that it is able to endure without inconvenience several weeks immersion, and that it often passes the winter in ground covered with water. During the short period it hibernates, and when at rest it forms a thin, somewhat iridescent epiphragm.

Mr. W. E. Collinge states that about Oxford it is generally found on the roots of grass in moist places at five to six inches beneath the surface; and other observers have noted it crawling amongst the roots of aquatic plants, quite submerged, and sometimes to a depth of six or eight inches.

Mr. Latchford subjected specimens in the summer season to forty-eight hours' immersion in an inverted test tube, containing no free air; he found the animals apparently lifeless when taken out, though they quickly recovered.

Z. nitidus is a favourite food of the Water-Rail, and Mr. Yarrell records that the stomach of that bird has been found quite filled with the young shells of this species. Dumont and Mortillet have remarked upon the partiality of this species for excrementitious and decaying animal matters, having observed it feeding upon the fæces of *Limax*, and within the shells of the larger Helices, devouring their decaying remains. It is also particularly fond of bones, feeding upon the gelatinous matter they contain, especially when this is softened by moisture or rain. As a bait, they found that bones spread among the Typhæ and Carices on the banks of the river were very efficacious traps, as quantities of specimens could be collected by examining the bait before sunrise.

In captivity, according to Dr. Gain, this species appears to feed chiefly upon moist dead leaves of oak, chestnut, and lime, but will also devour the fresh green leaves of lettuce, cabbage, scarlet-runner beans and onions, in addition to the roots of carrot and turnip and cooked potatoes.

Geological Distribution.—This species has not hitherto been found below the Pleistocene strata in the British Isles nor abroad.

PLEISTOCENE.—In South Wilts., it is quoted by Mr. Kennard from fluviatile deposits at Fisherton, near Salisbury.

The REPRODUCTIVE ORGANS show an OVOTESTIS composed of an oval aggregation of acini; the HERMAPHRODITE DUCT is short and almost direct, terminating near the base of the long and slender VESICULA SEMINALIS; the ALBUMEN GLAND is lobulated and ample; the OVIDUCT is sacculated and folded, continuing as a nearly straight FREE OVIDUCT, from whose upper section the globose, short-stemmed SPERMATHECA arises; the SPERM-DUCT is slender and runs with the sacculate oviduct, being continued as the VAS DEFERENS to the short and stout



FIG. 4.

FIG. 5.

FIG. 6.

FIG. 4 and 6.—Papillæ of *Vitrina hibernica*, showing two stages of development.

FIG. 5.—Reproductive organs of *Vitrina hibernica* after a dissection by Dr. Simroth.

ot. ovotestis; alb. gl. albumen gland; a. g. genital atrium; d. gl. dart gland, enclosing papilla or dart; h. d. hermaphrodite duct; o. free oviduct; p. penis sheath; pap. papilla; sp. spermatheca; sp. d. sperm duct; ut. uterus; v. d. vas deferens; v. s. vesicula seminalis.

PENIS SHEATH which it enters about midway; the DART GLAND is a long conspicuous organ, glandular at the distal end, and containing a papilla or dart, with a short, crenulated chitinous crown, hardened or strengthened by chitinous rods, the length of the papilla varying in different specimens according to the development of the gland.

The Rev. E. W. W. Bowell has recently published an account of the Irish specimens, regarding them as decidedly referable to *V. pyrenaica* Fér., which he affirms he has collected and examined in France.

The anatomical drawings published to establish this contention are, however, so deficient in the clearness and accuracy essential to the presentation of anatomical details, and the organs so misapprehended and misnamed, that little weight or importance can be attached to them.

Further, the *V. pyrenaica*, as figured by Férussac, is certainly not referable to our Irish shell, as a comparison of the figures here given will show. The shell is much larger, the coiling is appreciably less, and the degradation of structure is much further advanced in *V. hibernica*, while the whole contour of the shell is also different.



FIG. 7.—*Vitrina pyrenaica* Fér., natural size and enlarged (after Férussac).

Moreover, *V. pyrenaica* would appear to be a really indeterminate or dubious species, as Férussac never described it, and so far as he is concerned the species is known only by his figures of the shell and the following precise description of the locality where it is supposed to have been found:—*Helicolineax* "*pyrenaica* nobis, pl. ix., f. 3—Habit les Pyrénées à 200 ou 300 toises au dessus des Eaux Bonnes, vallée d'Ossian près de Pic du Midi."

Abbe Dupuy, a celebrated and enthusiastic conchologist, and author of one of the most important standard works on the Mollusca of France, who lived within reach of the published locality, regarded *V. pyrenaica* as a myth, stating that although he had often and assiduously sought expressly for it on the precise and only spot indicated by Férussac, he had only found *V. beryllina* or *V. elongata* there, and seems inclined to regard the illustrations as unprecise figures of the former species; while M. Mermet, who so especially and thoroughly studied the molluscan fauna of the Western Pyrenees, could never find and indeed never saw the species.

Moquin-Tandon describes *V. pyrenaica* in his work, but appears to have done so without personal knowledge, as his enumeration of the places in which it is said to be found, lack his usual mark of personal verification, and, further, his figure shows a much more globose and less degenerate shell than our *V. hibernica*.

We are, therefore, compelled to conclude that no valid grounds exist for the inclusion of *V. pyrenaica* amongst the Irish species, and that on the evidence here-with presented, the Irish shells must be known as *V. hibernica*.

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In West Sussex, Mr. J. P. Johnson found it in the spring of 1900 in the deposits on the fore-shore, exposed at low tide, near West Wittering, at the extremity of Bracklesham Bay.

In West Kent, it has been found in the beds in the vicinity of Erith and Crayford by Mr. A. Tylor.

In South Essex, it is recorded by Prof. Morris from the freshwater marls at Grays; by Kennard and Woodward as found by Dr. Corner in the brick-earth of Sam Green's Pit, Ilford; and by Mr. J. P. Johnson from the palæolithic beds at the Uphall Pit, Ilford. In North Essex, it is recorded from the freshwater marls at Copford and Clacton by Prof. Morris.

In Middlesex, it is cited by Mr. Kennard as present in the fluvatile deposits at Clapton and Westminster.

In East Suffolk, it is recorded from Stutton by Prof. Morris.

In Cambridge, Mrs. McKenny Hughes and the Rev. E. S. Dewick have found it in the gravels of Grantchester and Barnwell Abbey.

In Germany, it is recorded by Sandberger as found in the Lower Pleistocene tufa beds of Canth in Silesia and Mühlhausen in Thuringia; it is also quoted from the valley loess of Lower and Mid-Pleistocene age at Robschutz near Dresden and Cannstadt in Thuringia, as well as from the sands of Mosbach in Baden. In the Upper Pleistocene series it is cited from the tufa beds of Mühlhausen, Canth, and Weimar. It is reported by Mr. Kennard from Vitzenburg, and from Battendorf near Rossleben in the Harz Mountain district, and by Clessin from the alluvium at Pürklgut, Bavaria.

In Austro-Hungary, Sandberger cites it from tufa of Lower Pleistocene age, and the Mid-Pleistocene valley loess at Nussdorf near Vienna.

In Denmark, Dr. A. C. Johansen quotes it from the *Corbicula* beds by the Free Harbour, Copenhagen.

HOLOCENE.—In the Isle of Wight, this species is reported fossilized from the tufa bed to the south-east of Widdick Chine, Totlands Bay, by Kennard and Warren.

In East Kent, it has been found by the Rev. R. Ashington Bullen in a deposit overlying the head or rubble drift at Barton Court, Buckland, near Dover. In West Kent, it is recorded by Mr. Kennard from Charlton, and from a rain-wash of probably the Bronze age at Greenhithe, and was found by Mr. Spurrell in the sandy beds exposed in the excavations for the Metropolitan Sewer Outfall at Crossness near Woolwich.

In Surrey, it is reported by Mr. A. S. Kennard from the fluvatile carbonaceous silt and the underlying sandy loam deposits disclosed by the excavations in Tooley street, Bermondsey. It has also been found by Mr. T. Belt in the alluvial loamy clay deposit by the side of the river Thames at Kew.

In South Essex, Mr. B. B. Woodward has recorded that it has been found on the site of the Albert Docks, also at the Tilbury Docks, and in a section at the East London Waterworks, Walthamstow. Mr. Kennard cites it from Dagenham. In North Essex, Mr. Miller Christy records it from the deposits along the banks of the river Cann at Chigual St. James, and Mr. French from the alluvium at Felstead.

In Middlesex, it was discovered by Mr. Loydell in the old river bed, one mile west of Staines, on the tow-path to Old Windsor; by Mr. Meyer in the section on the site of Charing Cross Railway Station; by Mr. Greenhill in a sandy deposit of probably Bronze age at Clapton; by

Dr. Corner in a section exposed by sewer excavation at Canning Town ; and Mr. Kennard reports it from an excavation at London Wall, and from an alluvial deposit of post-Roman age at Uxbridge.

In Berkshire, Mr. Kennard reports it from Neolithic beds at Newbury.

In Oxfordshire, Mr. Kennard reports it from a buried land-surface of probably Bronze age at Caversham near Reading. Mr. H. J. Osborne White has found it at a depth of two feet in shell-marl in a meadow by the Thames opposite Wargrave, and Kennard and Woodward report it from a deposit by the Thames at Clifton-Hampden.

In Suffolk W., it has been found in a deposit of a now-drained lake of uncertain age, but probably post-Roman, at Knettishall.

In Gloucester W., Mr. Kennard reports it from a pre-Roman peat deposit at Westbury-on-Severn.

In York S.W., Dr. Corbett found specimens thrown up by the moles in the dried-up bed of an ancient lake at Askern.

In Ireland, Mr. Kennard reports it from an early alluvial deposit of the river Shannon at Limerick ; from co. Clare at Clanreen Craunogé and in a marl of uncertain age at Inchiquin.

In Germany, it is reported by Hesse from the tufa beds at Pymont.

In Belgium, it is recorded by Grégoire as rare in the "Tourbe" at Uccle lez-Bruxelles.

In France, M. Fagot has found it abundantly in the grey clays of Hers, Haute Garonne, and exactly similar to specimens still living in the neighbourhood.

In Sweden, it is recorded by Dr. Westerlund from a neolithic submarine turf deposit at Ystad.

In Denmark, Mr. Kennard reports it from South Zealand in deposits at Spjellerupgaard, and at Karebæk near Næstved.

Variation.—The variation of this species is not important ; an albino form has been noted, and the specimens vary in different localities, from a pale to a deep rich brown colour, while a form with slightly depressed spire has been named var. *borealis* by Dr. Westerlund.

The *Zonites nitidus* var. *parisiaca* Mabile (*Z. nitidus* var. *umbilicata* Baudon) described as a widely umbilicated variety, from the environs of Paris, and also recorded from the Oise and from Malmö in Sweden, may possibly be more correctly referable to *Z. excavatus*.

VARIATION IN SHELL.

Var. *machoi* Servain, Etudes Moll. en Esp., 1880.

SHELL very depressed in shape and openly umbilicated ; whorls 5, very convex and finely striated, suture deep. Aperture less lunate and almost round.

Diam. 5.5 mill. ; alt. 3 mill.

Spain—Seville and Granada, Andalusia.

Var. *albina* Moquin-Tandon.

Helix nitida var. β Jeffreys, Linn. Trans., 1830, vol. xvi., p. 339.

Zonites (Aplostoma) nitidus var. *albinus* Moquin-Tandon, Hist. Nat., 1855, p. 72.

Zonites nitidus var. *albida* Jeffreys, Brit. Conch., 1862, i., p. 167.

Hyalina nitida var. *viridula* Westerlund, 1876, p. 26.

Hyalina nitida var. *viridescens* Cockerell, Nat. World, 1885, p. 276.

SHELL white or whitish.

Sub-vars. *viridula* and *viridescens* differ in showing a greenish tinge.

Dr. Jeffreys in 1830 under the name of *H. nitida* var. β described as "*hyalina*, *albo-virescens*" an Irish specimen of this variety received from Mr. Dillwyn.

Surrey—"Specimens of this variety found by Mr. Choules amongst rejectamenta of the Thames at Richmond ; although dead shells, they have not become bleached by the sun" (Jeffreys, l.c.).

Lancashire S.—Recorded for Liverpool district by Mr. F. P. Marrat (Nat. Scrap Book, part i., p. 6).

Tipperary S.—Clonmel, July 1893! Rev. A. H. Delap.

Kerry—Sub-var. *virescens*, Valentia, T. D. A. Cockerell, l.c.

Germany—Cited for Alsace by Meyer.

France—Recorded by Wattebled as not rare on the banks of the R. Lone at Auxonne, department of Jura, and Moquin-Tandon cites the Upper Vosges.

Austro-Hungary—Hazay records an albine specimen at Trenčín-Teplicz.

Norway—Ringerige in Hamar Stift (Esmark, Journ. of Conch., 1886, p. 104).

Monst. **sinistrorsum** Cockerell, Sci. Goss., 1897, p. 262.

SHELL reversed in coiling.

France—Recorded by Gassies for Agen, department Lot et Garonne.

Geographical Distribution.—The area over which this undoubtedly ancient species has become diffused is very wide, but its habit of frequenting wet and marshy spots has been a potent hindrance to the acquirement of a true knowledge of its range.



FIG. 197.—Geographical Distribution of *Zonitoides nitidus* Müller in the Western Palearctic region.

In the British Isles it is probably universally distributed in suitable localities, but examples have not been authenticated from further north than Easternness, although it has been recorded by Fleming from the Shetland Isles.

Zonitoides nitidus is widely distributed over the whole of Europe, and has been reported from Algeria; it also ranges over Siberia, Turkestan, and Tibet, and was reported by Theobald from Cashmere.

In the New World it is diffused over the whole northern continent from Alaska to Alabama, and has been transported by commerce to Australasia, where it has probably now secured a permanent footing.

GERMANY.

In Germany the species is widely distributed, and records exist of its presence in Alsace, Baden, Upper and Lower Bavaria, East and West Brandenburg, Coburg, Darmstadt, Franconia, Hanover, Holstein, Lippe, Mecklenburg, Meiningen, Nassau, Oldenburg, Pomerania, Posen, Pyrmont, East, West and Rhenish Prussia, Silesia, Suabia, Thuringia, Weimar, Westphalia, Wurtemberg, and the Island of Rugen.

NETHERLANDS.

Holland—Recorded by Van den Broeck for Shluis-Kill and Exaerde in Zealand, and reported by Schepmann as inhabiting Gelderland, Limburg, Utrecht, and South Holland.

Belgium—Recorded from the provinces of Antwerp, Brabant, East and West Flanders, Hainault, Liège, Limburg, Luxemburg, and Namur.

FRANCE.

Z. nitidus is distributed throughout the country, and its occurrence has been noted in Ain, Aisne, Allier, Alpes Maritimes, Ardennes, Auvergne, Basses Pyrénées, Calvados, Champagne Méridionale, Charente Inférieure, Côte d'Or, Drôme, Finistère, Gard, Gers, Gironde, Hautes Alpes, Haute Garonne, Haute Loire, Hautes Pyrénées, Haute Saône, Hérault, Isère, Jura, Loire Inférieure, Lot et Garonne, Lozère, Maine et Loire, Manche, Meuse, Morbihan, Moselle, Nièvre, Nord, Oise, Pas-de-Calais, Pyrénées Orientales, Puy-de-Dôme, Rhône, Saône-et-Loire, Savoy, Seine, Seine Inférieure, Seine-et-Marne, Seine-et-Oise, Somme, Var, Vaucluse, Vendée, Vienne, Vosges, and the Island of Corsica.

SWITZERLAND.

Probably distributed all over the country, and has been specifically recorded as existing in the cantons of Aargau, Berne, Geneva, Grisons, Lucerne, Neuchâtel, St. Gall, Schwyz, Thurgau, Unterwalden, Uri, Valais, and Vaud.

ITALY.

Recorded for Piedmont, Lombardy, Tuscany, Emilia, Rome, and the Islands of Sardinia and Sicily.

SPAIN AND PORTUGAL.

Spain—Recorded by Hidalgo and others from the provinces of Valencia, Andalusia, Catalonia, Aragon, and the Balearic Isles.

BALKAN PENINSULA.

Albania—Found plentifully by Sturany on the shores of Ochrida See.

AUSTRO-HUNGARY.

Recorded from Hungary at Buda-Pesth, and the Hohen Tatra by Hazay; also from Austria, Bohemia, Carinthia, Carniola, Croatia, Dalmatia, Galicia, Goritz, Moravia, Transylvania, and Tyrol.

SCANDINAVIA.

Norway—Recorded by Dr. Westerlund for the south and middle region, by Miss Esmark as common in the southern part of the country, and specially noted for Christiania by Sars.

Sweden—In the southern parts and extending to 63° north lat. It has been cited from Blekinge, Kalmar, Gothenburg, Lund, and from the Island of Oeland; also from Medelpad in Westernorrland, from Skane, Warmland, and about Stockholm.

Denmark—Common and well distributed and is reported by Sell from Brøndshøj near Copenhagen, and from Lyngby in Zealand; at Hølekenhavn near Nyborg, Odense and Middelfart in Funen, and at Fredericia, Veile, Aarhus, etc., in Jutland, and Dr. Johansen quotes it from Bornholm.

RUSSIA.

Apparently fairly well distributed over the country, and extending to within the Arctic Circle. It has been specifically recorded from Courland, Crimea, Ekaterinoslav, Kharkov, Kursk, Grodno, Lapland, Livland, Moscow, Olonetz, Orenburg, Perm, Poland, St. Petersburg, Tambov, Tchernigov, and Vohlynia.

In Finland it is widely distributed over the country up to about 66° north lat.

In Transcaucasia, it is recorded by Boettger from the governments of Baku, Elizabetpol, Tiflis, and Kutais, and by Kobelt for Suchum in Abchasia.

NORTH AFRICA.

Algeria—Recorded by Forbes from the banks of the Harasch.

SIBERIAN SUB-REGION.

Siberia—Dr. Westerlund quotes this species as found in both East and West Siberia, and it has been especially recorded from Surgutskoj in the Yenissei valley in lat. $62^{\circ} 50'$. It is also quoted as in Ehrenberg's collection from Barnaul and Tomsk by Dr. von Martens.

It is tabulated by Dr. von Martens for the Altai region, for Khokand, and for the region east of the Aral Sea in **Syr-dariinskaya**.

In **Cashmere** it was found north of the Pir Panjal by Theobald; and Dr. von Martens records it for Little Tibet and for Ladak.

Japan—Mr. G. K. Gude gives *Euhyalinia radiatella* Reinhardt = *Zonitoides nitidus*, citing Tsu-shima, Hakodate, Yesso, and Kino-o-Shima as localities.

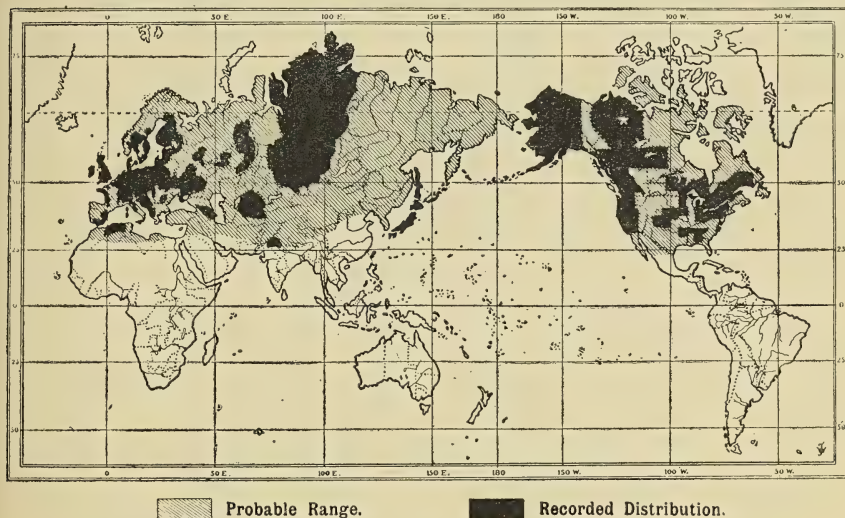


FIG. 198.—Geographical Distribution of *Zonitoides nitidus* Müller.

This species is widely dispersed over the whole Nearctic region, and has been recorded from many widely distant localities.

BRITISH NORTH AMERICA.

Athabasca—Peace river (Binney and Bland).

British Columbia—Laggan, near summit of Rocky Mountains, alt. 5,200 feet (G. W. Taylor).

Manitoba—Red River drift (Dall).

Mackenzie—Fort Resolution on Great Slave Lake (Binney and Bland).

Ontario—St. Thomas, Apr. 1886 (T. D. A. Cockerell). Abundant near Ottawa along outlet of Dow's Swamp, and in July 1883 was very plentiful by brook in Beaver Meadow, Hull (Litchford).

Quebec—Rare on banks of creek, St. Charles river (Hanham). Isle of Anticosti (Macoun). Quebec (H. Prime).

UNITED STATES.

Alaska—Cited by Dr. Dall and Krause from Klukwan.

Alabama—Baldwin co. (W. G. Binney).

Arkansas—Crawford, Conway, and Franklin counties (Mr. Sampson).

California—Mr. Orcutt states that it is not rare about San Diego, and plentiful in the grounds of the University of California at Berkeley.

Colorado—Recorded by Binney on the authority of Lient. Carpenter as found in the alpine region at an altitude of 12,000 feet.

Indiana—Enumerated for Connersville, Fayette co., by A. J. Reynolds, and for Henry co. (E. Pleas).

Iowa—Hardin co. (Keyes). Abundant on islands in Mississippi river, and by creek, Bellevue (Sargent).

Michigan—Widely distributed throughout the state, and is tabulated by Mr. Walker for thirty-nine of the eighty-four counties into which the state is sub-divided.

Minnesota—Found by Clearwater Lake, Wright co., by Mr. H. E. Sargent.

Nebraska—Aughey reports it as rare in Dixon and Knox counties.

Nevada—East slope of Sierra Nevada (Call).

New Jersey—Quoted by Mr. M. Schick as common at Westville and West Park.

New York—Dover Plains, Dutchess co., Nov. 1889 (W. S. Teator); Greenwich, Washington co. (Binney and Bland); abundant, Mohawk Valley, etc., Herkimer co. (J. Lewis); Onondago co. (Beauchamp); Pittsford, Monroe co. (Walton); Richfield Spa, Otsego co., Aug. 1906 (Smith); New Lotts, Long Island (H. Prime); abundant about old mill ruins, Cazenovia (G. H. Clapp); Plattsburgh (Hudson); Hayden's Mill near Auburn, Apr. 1882 (F. C. Baker); Cayuga Lake Valley (Banks).

Ohio—Cincinnati (Byrnes); Columbus, Franklin co. (Moore); abundant, Kent, Portage co.; Akron and Hudson, Summit co. (Dean); Garrettsville (Luther).

Oregon—Astoria (Hemphill).

Pennsylvania—Allegheny co. (Stupakoff); Blairsville (Harn); swarming near Strawberry Mansion, East Park, Wissahickon, Nov. 1893 (Vanatta).

Rhode Island—Pawtuxet River Falls, Pawtuxet (Perry); Stafford Lake, Tiverton (J. H. Thomson).

Tennessee—Knoxville, Knox co. (Andrews).

Washington—Abundant in all the greenhouses of Seattle (P. B. Randolph).

AUSTRALASIAN REGION.

New South Wales—Darling Point, Lyndhurst, and elsewhere about Sydney (Cox); Rushentter's Bay (Brazier).

Victoria—About the greenhouses of the Botanic garden, Melbourne, April 1905! (J. H. Maiden and W. Denison Roebuck).

INTRODUCED SPECIES.

In addition to the *Zonitidae* enumerated in the preceding pages, some others have been recorded as recently found in this country, purposely or accidentally introduced with plants or produce of various kinds, although there is no reason to suppose that they will ever become truly naturalized in this country. They are—

Hyalinia cantabrica Westerlund.—A form closely allied to or varietally identical with *H. alliaria*, which inhabits Spain and has been found plentifully by the Rev. R. Godfrey in one of the hothouses in the Botanical Gardens, Edinburgh.

Zonitoides minusculus Binney.—This Nearctic species which Mr. B. B. Woodward has recently included in the British list and proposed to add to our native fauna, was found in 1883 by Mr. C. T. Musson amongst moss in an orchid house, belonging to Mr. Thacker, Blue Bell Hill, Nottingham.

It is a minute, whitish shell, scarcely $2\frac{1}{2}$ mill. in diameter, with four microscopically wrinkled and rapidly increasing whorls and a wide umbilicus.

This species is diffused all over North America, from Alaska and its islands to the extreme south, and is also an inhabitant of Bermuda and of Jamaica and several other of the West Indian islands.

Distribution of *Zonitoides nitidus* (Müll.).

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
1 Cornwall W.	41 Glamorgan
2 Cornwall E.	42 Brecon
3 Devon S.	43 Radnor
4 Devon N.	44 Carmarthen
5 Somerset S.	45 Pembroke
6 Somerset N.	46 Cardigan
7 Wilts N.	47 Montgomery
8 Wilts S.	48 Merioneth
9 Dorset	49 Carnarvon
10 Isle of Wight	50 Denbigh
11 Hants N.	51 Flint
12 Hants S.	52 Anglesey
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
15 Kent E.	55 Leic. & Rutld.
16 Kent W.	56 Notts.
17 Surrey	57 Derby
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid
21 Middlesex	61 S.E. York
22 Berks.	62 N.E. York
23 Oxford	63 S.W. York
24 Bucks.	64 Mid W. York
25 Suffolk E.	65 N.W. York
26 Suffolk W.	66 Durham
27 Norfolk E.	67 Northumb. S.
28 Norfolk W.	68 Cheviotland
29 Cambridge	69 Westmorland
30 Bedford	70 Cumberland
31 Hunts.	71 Isle of Man
32 Northampton	
33 Gloucester E.	
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

72 Dumfries	W. LOWLANDS	E. HIGHLANDS
73 Kirkcudbright		
74 Wigtown		
75 Ayr		
76 Renfrew		
77 Lanark		
78 Peebles	E. LOWLANDS	W. HIGHLANDS
79 Selkirk		
80 Roxburgh		
81 Berwick		
82 Haddington		
83 Edinburgh		
84 Linlithgow		
85 Fife & Kinross	E. HIGHLANDS	
86 Stirling		
87 Pth. S. & Clkn.		
88 Mid Perth		
89 Perth N.		
90 Forfar		
91 Kincardine		
92 Aberdeen S.		
93 Aberdeen N.		
94 Banff		
95 Elgin		
96 Easternness		
97 Westernness		
98 Main Argyle		
99 Dumarton		
100 Clyde Isles		
101 Cantire		
102 Ebudes S.		
103 Ebudes Mid		
104 Ebudes N.		
105 Ross W.		
106 Ross E.		
107 Sutherland E		
108 Sutherland W		
109 Caithness		
110 Hebrides		
111 Orkneys		
112 Shetlands		

IRELAND.

113 Derry	ULSTER	LEINSTER
114 Antrim		
115 Down		
116 Armagh		
117 Monaghan		
118 Tyrone		
119 Donegal		
120 Fermanagh		
121 Cavan		
122 Louth		
123 Meath		
124 Dublin		
125 Kildare		
126 Wicklow		
127 Wexford		
128 Carlow		
129 Kilkenny		
130 Queen's Co.		
131 King's Co.		
132 Westmeath		
133 Longford		
134 Roscommon	CONNAUGHT	
135 Leitrim		
136 Sligo		
137 Mayo E.		
138 Mayo W.		
139 Galway W.		
140 Galway E.		
141 Clare	MUNSTER	
142 Limerick		
143 Tipperary N.		
144 Tipperary S.		
145 Waterford		
146 Cork N.		
147 Cork S.		
148 Kerry		

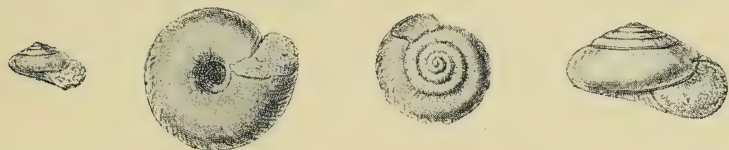
Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

FOSSIL SPECIES.

Hyalinia d'urbani* (Edwards).Helix d'urbani* Edwards, Mon. Eoc. Moll., 1852, pt. ii., pp. 62, 63, pl. x., ff. 5 A-D.*Helix keepingi* Edwards MS., Edwards' Collection, British Museum.*Helix omphaloides* Edwards MS., Edwards' Collection, British Museum.*Hyalinia d'urbani* Edwards (after Edwards).FIG. 199.—Natural size. FIG. 200, 201, and 202.—Lower, upper, and frontal aspects $\times 2$.

SHELL smooth, depressed and moderately but perspectively umbilicated; SPIRE somewhat raised; WHORLS about five, convex in the adult, but slightly carinate when young; SUTURE somewhat channelled; APERTURE crescentic; PERISTOME simple and direct. Diam. 10 mill.; alt. 5 mill.

A variety occurs in which the spire is more depressed, the whorls consequently assuming a less bluntly convex form.

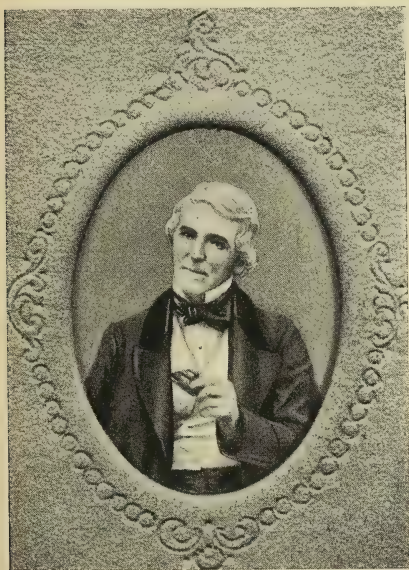
The smooth and polished surface, with faint growth lines and thin unreflected lip, prevent its being confused with *H. vectiensis*, which is of somewhat similar outline, but although not an uncommon species, it is generally casts only that are found, in which condition the width of the umbilicus is almost the only character distinguishing it from *H. vectiensis*.

This species is here associated with the distinguished palaeontologist, Mr. Frederic E. Edwards, the author of the superb Monograph of Eocene Mollusca, published many years ago by the Palaeontographical Society, and still the standard work upon the subject.

Mr. Edwards named this species in honour of the late Mr. J. d'Urban,

the palaeontologist. It is said by its author to somewhat resemble *H. lemani* of Prof. Brongniart, but the spire is less elevated and the umbilicus more open, while Sandberger remarks that though flatter and more widely umbilicated, it resembles *Helix voltzii* from the Upper Eocene of Buxweiler in Alsace.

According to Mr. R. S. Gardner, the *Helix keepingi*, *H. omphaloides*, and *H. morrisii* of Edwards, may all be appropriately referred to *Helix d'urbani*, the two first-named being also so labelled in the British Museum.



Frederic E. Edwards

To facilitate comparison with the original figures of *H. d'urbani* and *H. morrisii*, the annexed engravings of *H. keepingi* from Sconce and *H. omphaloides* from Headon Hill are reproduced from photographs of the type specimens in the Edwards' Collection, British Museum.

Unfortunately, I have not had the opportunity of inspecting the specimens, and no detailed descriptions are available.

Judging by the photographs, *Hyalinia keepingi* is a larger shell than either *H. d'urbani* or *H. omphaloides*, being about 12 mill. in diameter, with a convex spire of about four whorls, somewhat rudely and irregularly striate in the line of growth.

The *H. omphaloides* is a much smaller shell, but with about $5\frac{1}{2}$ whorls, the largest specimen measuring about 7 mill. in diameter, with distinct and deep

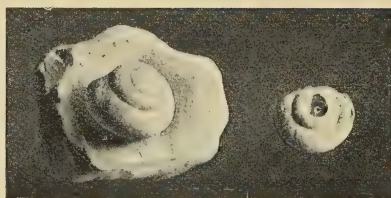


FIG. 204.—*Hyalinia keepingi* (Edwds., MS.), Sconce, Isle of Wight.

(After photograph from original examples in the British Museum).



FIG. 205.—*Hyalinia omphaloides* (Edwds., MS.), Headon Hill, Isle of Wight. (After photo. from original examples in British Museum).

sutures, and somewhat irregularly undulate striae in the lines of growth; the umbilicus is open and distinct, and about mid-way between the umbilicus and the angulate periphery there is a well-marked basal keel of which no trace can be seen in the published figures of *H. d'urbani* or *H. morrisii*.

BRITISH ISLES.

Oligocene—In the Bembridge limestone at Sconce, Headon Hill, Bembridge, Hempstead, Whitecliff Bay, etc., Isle of Wight.

Hyalinia morrisii (S. V. Wood).

Helix morrisii (Edwards MS.), S. V. Wood, Monog. Paleont. Soc., 1877, p. 331, pl. xxxiv., f. 5a, b.

SHELL somewhat lenticulate, subdepressed, periphery angulated, indistinctly striate in the line of growth; **SPIRE** convexly produced; **WHORLS** five, slowly increasing in size, the last ample, convex and smooth beneath, distinctly umbilicate; **APERTURE** subquadrate and somewhat oblique; **PERISTOME** simple, acute.

Diam. 9–10 mill.

This species is considered as distinct by Mr. F. E. Edwards and Mr. Searles V. Wood, but regarded as a form of *H. d'urbani* by Mr. Gardner. Judging from the published figures here reproduced, *H. morrisii* appears worthy of specific recognition.

It belongs to the Oligocene fauna, and according to Mr. Wood bears a slight resemblance to *Helix heberti* Desh. from the Lower Tertiaries of France, but still more closely approaches the *Helix dubia* Desh., a species whose presence in our English deposits is denied by Edwards.

BRITISH ISLES.

Oligocene—In the Bembridge limestone at Bembridge, Sconce, Headon Hill, Hempstead, Whitecliff Bay, etc., Isle of Wight.

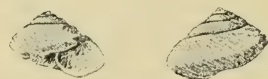


FIG. 206.—*Hyalinia morrisii* (S. V. Wood) slightly enlarged (after Wood).

Hyalinia sconciensis (Newton & Harris).

Helix sconciensis (Edw. MS.) Gardner, Geol. Mag., 1885, p. 249 [nomen nudum].
Vitrea sconciensis Newton & Harris, Proc. Mal. Soc., 1894, i., p. 71, pl. 6, f. 13.

SHELL much depressed, subdiscoidal, and umbilicated; WHORLS five, ornamented with numerous closely-set striae, which extend over the whole surface quite to the umbilicus; SUTURE deep; SPIRE slightly elevated; LIP simple.

Diam. 9 mill.; alt. 4 mill.

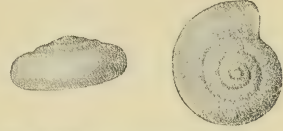


FIG. 207.—*H. sconciensis* (N. & H.), enlarged (after Newton & Harris).

Messrs. Newton & Harris remark that its nearest ally is *Helix d'urbani* Edwds., which occurs in the same beds, but the present species differs in the highly ornate character of the striation, more depressed spire, and slightly larger umbilicus.

BRITISH ISLES.

Oligocene—In the Bembridge limestone series, Sconce, Isle of Wight.

Hyalinia leia (Newton & Harris).

Helix leia (Edwards MS.) Newton, Syst. List Edw. Coll. Brit. Mus., 1891, p. 270.
Vitrea leia Newton & Harris, Proc. Mal. Soc., Mel. 1894, i., p. 71, pl. vi., f. 14.

SHELL depressed, discoidal, and umbilicated; WHORLS four, regularly increasing, the surface polished and showing numerous obscure lines of growth; APEX very obtuse; APERTURE subovate, and extending to the margin of the umbilicus, which is small and deep.

Diam. 6 mill.; alt. 2.5 mill.



FIG. 208.—*H. leia* (N. & H.), enlarged (after Newton & Harris).

According to the describers, this is a small and delicately formed shell, having a contour very similar to that of *Hyalinia cellaria*, but differing in its much more depressed spire, and it may be added more laterally expanded last whorl. Only one specimen is known of this form.

BRITISH ISLES.

Oligocene—Headon limestone series, Headon Hill, Isle of Wight.

Hyalinia dawsoni (Moore).

Helix dawsoni Moore, Quart. Journ. Geol. Soc., 1867, p. 549, p. xv., f. 12.

Original Description.—"Shell small; spire but slightly elevated, with about four apparently small convex volutions, divided by a slight sulcus; the base of the shell is slightly crushed, but it is seen to be flattened and to possess a deep and rounded umbilicus with a rounded aperture."

"The somewhat imperfect condition of this shell, of which I have but one specimen, renders it rather difficult to determine it with precision; but its generic determination is facilitated by its being found in association in the same deposit with the land and freshwater genera I have previously enumerated."



FIG. 209.—*H. dawsoni* (Moore) enlarged, after Moore

Mr. Kenneth McKean, who has kindly examined the type specimen in the Museum of Bath, reports that the original specimen is less than a millimetre in diameter, and secured within glass tubing upon a cement into which the shell has partially sunk, but that he could not discern markings of any kind upon the smooth surface of the whorls.

BRITISH ISLES.

Lias—Found by Moore in a bed of clay, twelve feet in thickness, at a depth of 270 feet, in the Charter-House lead mine, Mendip Hills, North Somerset.

GENUS *GASTRODONTA* Albers.

SHELL subperforate or umbilicate, depressed, or orbicularly convex, light horn colour, and sometimes transparent; WHORLS 5-7, finely and obliquely striate; APERTURE lunate, base furnished with longitudinal teeth or folds, which do not reach the apertural margin; PERISTOME simple and acute.

ANIMAL usually darkly pigmented; FOOT long and narrow, with distinct locomotor disc; PEDAL GROOVES distinct, terminating in a longitudinal mucous pore; JAW strongly arcuate, ends rounded, anterior surface striated, concave margin with a well-developed median projection or beak.

LINGUAL RIBBON bearing a tricuspid central tooth with bicuspid laterals and aculeate marginals.



FIG. 210.

FIG. 210.—Mandible of *Gastrodonta [liger]* enlarged (after Bryant Walker).



FIG. 211.

FIG. 211.—Representative median, lateral, and marginal teeth of *Gastrodonta [liger]* highly magnified (after Binney).

The *Gastrodontæ* are at the present day restricted in a living state to North America, and only known in this country by their fossil remains.

***Gastrodonta headonensis* (Edwards).**

Helix headonensis Edwds., Mon. Eoc. Moll., 1852, pt. 2, p. 70, pl. xi., f. 5 a-d.

Gastrodonta headonensis Sandberger, Vorwelt, 1873, p. 276, pl. xiv., ff. 21-24c.



FIG. 212.—*Gastrodonta headonensis* (Edwards), natural size and $\times 5$ (after Edwards).

SHELL very small and depressly orbicular, with a somewhat elevated SPIRE of six or seven rounded WHORLS, separated by a deep SUTURE; APERTURE semi-lunar; PERISTOME slightly thickened internally and outwardly reflected, outer wall of the last volution bearing three long and parallel longitudinal lamellæ extending far back, but not reaching the APERTURE; UMBILICUS wide and deep.

Diam. 2.5 mill.; alt. 1.25 mill.

According to Edwards, *G. headonensis* is extremely rare, but is a well-marked and perfectly distinct species, the specimen figured being merely a cast. He remarks on its resemblance to the depressed variety of *H. labyrinthica*, but the greater number of whorls and the different dentition of the aperture sufficiently distinguish it.

In general aspect it resembles *Vallonia pulchella*, but the spire is more elevated, and the whorls are more numerous, while the internal longitudinal plaits are especially distinctive.

Prof. Sandberger remarks on its similarity in some respects to *Gastrodonta lasmodon*, a native of Alabama and Tennessee; but although the form and position of the lamellæ are quite the same, the recent species is without the distinctly margined aperture and is of very much larger size.

BRITISH ISLES.

Oligocene—In the Headon limestone at Headon Hill; also in the Bembridge series at Hempstead, Bembridge, Whitecliff Bay, etc., Isle of Wight (C. Ashford); and in the Headon series at Hordwell, Hants.

Punctum pygmæum (Draparnaud).

- 1789 *Helix minuta* Studer, Fauna Helvet., vol. iii., p. 428 (nomen nudum).
 1801 — *pygmæa* Draparnaud, Tabl. Moll., p. 93.
 1823 — *kirbii* Sheppard, Linn. Trans., vol. xiv., p. 162.
 1841 — *minutissima* Lea, Trans. Amer. Phil. Soc., vol. ii., p. 82.
 1855 — (*Delomphalus*) *pygmæa* Moq.-Tand., Hist. Moll., vol. ii., p. 102, pl. x., ff. 2-6.
 1833 *Discus pygmæus* Fitz., Syst. Verz., p. 99.
 1837 *Euryomphala pygmæa* Beck, Index Moll., p. 9.
 1837 *Patula pygmæa* Held, Isis, p. 916.
 1840 *Zonites pygmæus* Gray, Turton's Manual, Brit. Shells, p. 167, pl. 5, f. 46.
 1855 *Microphysa pygmæa* Binney, Manual Amer. Land Shells, p. 71, ff. 31-33.
 1864 **Punctum** *minutissimum* Morse, Journ. Portland Soc. Nat. Hist., p. 28, f. 70.
 1866 *Conulus minutissima* Tryon, Amer. Journ. Conch., vol. ii., p. 257, pl. 4, f. 63.
 1870 *Hyalina minutissima* Binney in Gould's Invert. Mass., p. 403.
 1883 *Patula* (*Patulastra*) *pygmæa* Boettger, Jahrb. Deutsch. Mal. Ges., p. 316.



G. Schacko

HISTORY.—*P. pygmæum* (*pygmæum*, small or tiny) was first noticed by Studer, although Draparnaud was the first to publish a description and figure, while Dr. J. E. Gray in 1821 in the "Medical Repository" first made known its claims to rank as a British species.

It is the *Helix elegans* and also the *Helix kirbii* of the Rev. Revett Sheppard, who in 1823 described and published it under the latter name, but the species was regarded by Leach, Fleming, and others of that period as only the young state of *Helix rupestris*.

This minute species is associated with Herr G. Schacko, of Berlin, the esteemed and life-long collaborator of Dr. E. von Martens, who first demonstrated the possession of the composite mandible in the European form, and has also investigated the internal structure of many of the more minute and

difficult species of European mollusca.

Diagnosis.—*P. pygmæum* may be distinguished from its closest ally *Pyramidula rupestris* by its smaller size, more delicate striation, paler colour, fewer whorls, more depressed spire, more open umbilicus, and shallower suture.

INTERNALLY, it may be separated by the compound character of the jaw, that of *P. rupestris* being semi-lunar and faintly striated.

Description.—The ANIMAL is very small, of a greyish or brownish colour, minutely speckled with black, darker upon the HEAD and BACK, and more translucent below; TUBERCLES flat and rounded; OMMATOPHORES cylindrical and abruptly thickened at their origin; EYES large; FOOT narrow, with a slightly keeled TAIL; and carries its SHELL quite horizontally when crawling.

SHELL depressed, of a pale brown or yellowish-horn colour, rather glossy, lustrous, thin, and semitransparent; SPIRE slightly exserted; and composed of about four cylindrical WHORLS, which increase gradually in size; the SURFACE ornamented with fine and regular transverse striation, and delicate microscopic

spiral lineation, which is most perceptible in the umbilical region; APEX or nucleus glossy and transparent; SUTURE distinct; UMBILICUS wide and exposing all the internal spire. APERTURE obliquely lunate; LIP simple, with slightly inflected extremities. EPIPHRAGM very delicate and thin.

Diam. 1.2 mill.; alt. 0.6 mill.

When the animal is retracted, the ommatophores may be seen through the shell substance, directed towards the umbilicus.

INTERNALLY, little is known of its structure, its minute size being a great hindrance to successful dissection. Lehmann has, however, recorded the absence of the dart sac and mucous glands, and described the cylindrical spermatheca duct as short, thick, and of a bluish-grey colour; while St. Simon has described the kidney or precordial gland as abruptly dilated behind, and the albumen gland as comparatively large and broad, composed of loose tissue, and of a transparent grey.

The JAW, according to Herr Schacko, is of strongly arcuate form, and nearly circum-oral, composed of nineteen quadrate plates, quite separate one from the other, and formed of long chitinous fibres which extend as a fringe beyond their sharp free edges; the median plate is described as quite isolated, but the side plates overlap laterally more and more, the terminal plate at each extremity covering nearly two-thirds of the adjacent one, and all are connected by a delicate membrane. Dr. Pilsbry remarks that in the Nearctic form the segments are not in the least soldered together, but the Rev. E. W. W. Bowell has assured me that in Britain the separate plates ultimately become fused.



FIG. 215.—Jaw of *P. pygmeum*, highly magnified (after Schacko).

The LINGUAL MEMBRANE of a German specimen consists according to Schacko of 114 sinuous transverse rows, each composed of thirty-nine distinctly isolated teeth, even the cutting points or cusps not reaching to or overhanging the basal surface of the adjacent rows. The transverse rows are each composed of a long and narrow median tooth, with a tricuspidate reflection, although the side-cusps are occasionally so small as to be scarcely perceptible; the laterals are double the width of the central tooth, and bicuspid, with rounded cutting points, merging gradually into the less definite marginal teeth. The formula is $19 + 1 + 19 \times 114 = 4,446$ teeth.



FIG. 216.—Transverse row of teeth from the odontophore of *Punctum pygmeum* (Drap.), Cambridge, highly magnified, prepared by Prof. H. M. Gwatkin.

A British specimen showed a well-defined, though slender, trifid median tooth, flanked by many practically bicuspidate laterals, with simply hooked reflections, which gradually blend with the obscurely tricuspid marginals.

The formula of a Cambridge specimen of *P. pygmeum*, prepared by Prof. Gwatkin, is $\frac{4}{3} + \frac{1}{2} + \frac{1}{3} + \frac{1}{2} + \frac{1}{3} \times 48 = 1,776$, but the preparation may be imperfect, as Prof. Gwatkin quotes sixty-five transverse rows as present in a Tenby specimen.

Reproduction and Development.—Nothing is known of the details of the congress of this species, but Gassies records that usually during August and September about a score of very small and opaline eggs are deposited, which hatch in due course, the young becoming adult near the end of the following year.

Habits and Habitat.—This species would seem to have little geological preference, being found equally on limestone and sandstone soils, living chiefly in moist and shady places within or at the margins of woods, hiding beneath stones, at the roots of grass, or amongst moss, principally favouring *Hypnum purum* and *H. lutescens*, but is also very

frequently found living beneath dead and decaying leaves or adhering to fallen branches.

It is of a timid and irritable disposition, and shrinks within its shell at the least alarm or when exposed to bright sunlight.

M. St. Simon was very successful in taking considerable numbers of this minute shell by sweeping, with an entomological gauze net after rain, the wet grass and herbage, and it may also be found in some numbers by collecting in known localities a quantity of the moist dead leaves, which, when dried, allow the shells to be easily separated.

In North America, Prof. Morse describes their preference for the rotten bark of beech trees in the denser woods, and as being not unfrequent in the larger species of fungi, such as *Boletus* and *Polyporus*.

Geological Distribution.—*P. pygmæum* is undoubtedly one of our most ancient terrestrial species, and the immensity of time it has existed has enabled it to extend its range over the whole of the Holarctic realm.

The *Punctum propygmæum*, described by Andree from the Miocene beds of Oppeln in Silesia, exhibits only the very slightest differences from the recent shells.

Under its own name, *P. pygmæum* has, however, been recorded from various horizons, but not lower than the Pliocene beds.

LOWER PLIOCENE.—Cited by M. Arnould Locard from the Lower Pliocene deposits at Hauterive, department of the Drôme.

PLEISTOCENE.—In Wilts. S., it is reported by Mr. Blackmore as found in the loess at Fisherton Anger near Salisbury.

In West Sussex, Mr. J. P. Johnson has found it in the buried river-bed deposits exposed at low-tide on the foreshore at West Wittering.

In West Kent, Mr. F. C. J. Spurrell discovered it in the sandy deposit at the reservoir of the Metropolitan Southern Sewer Outfall at Crossness.

In South Essex, it is recorded from the freshwater marls of Grays by Mr. Searles V. Wood, and by Mr. J. P. Johnson from the Uphall Brickyard at Ilford. In North Essex, it is recorded by Kennard and Woodward from the freshwater marls of Copford.

In Cambridge, it has been collected from the gravels at Barnwell Abbey by the Rev. E. S. Dewick.

In South-east Yorkshire, Mr. T. Sheppard has recorded it from a dark lacustrine marl at Bealsbeck near Market Weighton.

In Germany, Prof. Sandberger cites the species as not rare in the Lower Pleistocene sands of Mosbach, in Baden, and from the tufa of similar age at Cannstadt in Thuringia; also as very rare in Valley loess of Lower and Middle Pleistocene age at Grotzingen near Durlach, Baden. Dr. Koch has also detected it in the lower layers of the loess in the Rheingau, Nassau; and Herr Clessin in the alluvium of Pürklgut, Bavaria.

In France, Mr. T. Blackmore records it as being found at the base of the Upper Pleistocene loess or fluvio-marine sand of Menchecourt, near Abbeville, department of the Somme.



FIG. 217. — *Punctum propygmæum* Andree, magnified (after Andree).

HOLOCENE.—In Dorset, this species was found by Mr. J. H. Austen in the Neolithic tufa of Blashenwell, near Corfe Castle.

In South Essex, Kennard and Woodward record it from the excavations for the East London Waterworks reservoirs at Walthamstow; while in North Essex it is tabulated by the same authors for Witham, Braintree, Raine, Chignal St. James, and Shalford.

In Middlesex, Mr. A. Loydell found fine specimens in the marly alluvium of the Thames at Staines.

In Oxford, Kennard and Woodward report it from deposits on the banks of the Thames at Clifton-Hampden.

In West Gloucester, it is recorded by Mr. A. Santer Kennard from the pre-Roman peat beds of Westbury-on-Severn.

In South-east Yorkshire, Dr. Corbett has detected specimens in the ancient lacustrine deposit at Askern.

In Ireland, Mr. R. Standen found this species represented in the earthy deposit at Dog's Bay, West Galway.

In Belgium, M. Lecomte records the finding of fossil specimens in the deposits of the Valley of the Dendre.

In Denmark, it is recorded by Dr. A. C. Johansen from the deposits by the Free Harbour, Copenhagen, and by Elberling from those at Veistrup in Funen, and Neder Knaberup and Haraldskjær in Ribe Stift, Jutland.

Variation.—Little variation has been noted in this species, possibly on account of the minute size of the shell. Several species have, however, been described which, by impartial and competent judges, have afterwards been united with *P. pygmæum*, but may possibly on critical investigation show peculiarities which would render it advisable to retain the names as indicating noteworthy modifications; such are *Helix balatonica* Servain, from Hungary, which is referred by Dr. Kobelt to this species, and the Italian form described as *Helix schwerzenbachiana* by Calcara, which is allocated here by Dr. Pilsbry.

The Nearctic form, *P. minutissimum*, is here regarded as the forerunner of and as racially different from the European type; the immensity of time during which it has been isolated from the Palearctic region, and the structural differences described as existing between the two, being sufficient warrant for this course.

Var. *albina* Reinhardt.

Dr. Reinhardt speaks of an albine variety of this species which he found in Bohemia and Silesia in the subalpine regions of the Riesengebirge, but as this author does not definitely state the shell to be white, it is not improbable that it may be merely somewhat paler than ordinary, as in some other species to which he has attributed albine forms.

Bohemia—Dr. P. Hesse records the albine variety as occurring as commonly as the type in the Pine zone on the southern slope of the Riesengebirge, and Dr. Reinhardt describes it as similarly plentiful on the subalpine slopes of the same mountain range up to altitudes of 4,000 feet.

Silesia—Dr. Reinhardt records it as existing commonly with the type in the small snow cavities on the northern slopes of the Riesengebirge, ascending to altitudes exceeding 4,000 feet.

Monst. *sinistrorsum* Taylor.

SHELL reversed.

A specimen of this form was, according to Mr. B. B. Woodward, formerly in the collection of the Rev. E. S. Dewick, who discovered it in the Pleistocene Gravels of Barnwell Abbey, Cambridgeshire.

P. pygmæum minutissimum (Lea).*Helix minutissima* Lea, Trans. Amer. Phil. Soc. 1841, ii., p. 82.*Helix minuscula* Binney, Terr. Moll., ii., p. 221.*Punctum minutissimum* Morse, Journ. Portl. Soc., 1864, p. 27 and figs.*Conulus minutissima* Tryon, Amer. Journ. Conch., 1866, ii., p. 257, pl. 4, f. 63.*Hyalina minutissima* Binney, Gould's Invert. Mass., 1870, p. 403.*Microphysa pygmaea* Binney, Man. Amer. Shells, 1885, p. 71, ff. 31-33.

W. G. Binney

THIS ancient race of *Punctum pygmæum* is the object of great differences of opinion as to its exact identity or otherwise with the Palearctic form; but as certain conchological and structural peculiarities have been described as characterizing the American form which have not yet been controverted, it is deemed desirable to recognize its claims to racial distinction.

This interesting Nearctic race is associated with one of the most famous of contemporary conchologists, and a leading pioneer in the systematic utilization of the details of anatomical structure in the discrimination and classification of species—Mr. W. G. Binney, of Burlington, New Jersey, U.S.A., author of many excellent standard manuals upon American conchology, and who, during 1874 in conjunction with the late Mr. Thomas Bland, published a monographic account of the history and structure of the present species.

P. pygmæum minutissimum is said to never attain the dimensions of the European *P. pygmæum*, while the suture is always nearer the centre of the body-whorl, and the spire is consequently more elevated; the whorls are also more compact and revolve more closely, while the aperture is more oblique.

The two forms when highly magnified exhibit faint revolving lines, which in *P. pygmæum* are more distinct and wider apart; while the prominent transverse striae are also more regularly disposed and wider apart in the European form.



FIG. 219.

FIG. 219.—*P. pygmæum* (Drap.) magnified, Florence, Italy (after Morse).



FIG. 220.

FIG. 220.—*P. minutissimum* (Lea) magnified, Bethel, Maine (after Morse).

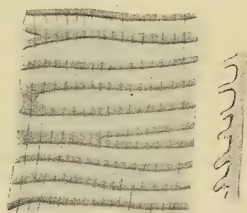


FIG. 221.—Magnified surface sculpture and cross-section of the body-whorl of *P. minutissimum* (after Morse).

The shell is described as having the surface of the whorl raised in a series of coarse ridges, parallel with the lines of growth, becoming more distinct and prominent as the umbilical region is approached, and often coalescing at or near their junction with the suture; the faint revolving lines also become more prominent near the umbilicus and appear to be arranged in pairs.

The JAW or mandible is said to be composed of sixteen long, slender, corneous laminae, all of which are recurved at their cutting edges; the median segments are described as quite isolated, while the lateral laminae partially overlap each other.



FIG. 222.

FIG. 222.—Mandible of *Punctum minutissimum*, highly magnified (after Morse).



FIG. 223.

FIG. 223.—Half a transverse row of the radula of *P. minutissimum*, highly magnified (after Morse).

The LINGUAL MEMBRANE is described by Morse as bearing fifty-four transverse rows of transparent horn-coloured teeth, each row composed of one median and twenty-six lateral or marginal teeth. The median tooth is described as being the largest in the row, with one very small and rounded cutting-point; the long and narrow laterals become even narrower as they approach the side of the membrane, and show two short and equally rounded cusps, increasing to three indistinctly reflected points towards the extreme margins of the membrane.

The formula according to Morse is $13 + 1 + 13 \times 54 = 1,458$ teeth.

Nearctic Distribution.—This race is probably widely dispersed over the whole Nearctic region, but the records are as yet only fragmentary.

BRITISH NORTH AMERICA.

British Columbia—Vancouver's Island (Rev. G. W. Taylor, Naut., 1891, p. 92).

Manitoba—Winnipeg (A. W. Hanham, Nautilus, 1899, p. 3).

Quebec—Quebec, fairly common (A. W. Hanham, Nautilus, Jan. 1897).

UNITED STATES.

Alaska—*P. pygmeum* tabulated for Alaska by Dr. Hermann Jordan.

Alabama—Woodville, Jackson co. (Sargent, Nautilus, 1892, p. 77).

California—San Francisco and Haywards, Alameda co. (Dr. J. G. Cooper). Lone Mountains (Binney, Terr. Moll., 1878, v., p. 412).

Colorado—Willow Creek, Custer co., and Clouderoft, T. D. A. Cockerell.

Indiana—Henry co. (E. Pleas, Nautilus, 1893, p. 69).

Iowa—Jasper co. and Iowa city (H. Prime). Polk, Johnson, and Scott counties (Keyes, Bull. Essex Inst., 1888, p. 66).

Maine—Abundant throughout the southern parts of the state. In one locality I counted eighty-three specimens on a single small leaf (E. S. Morse, l.c.). Rare in the north-east of the state (Nylander, Nautilus, 1900, p. 104). Bethel (E. W. Roper, Nautilus, 1890, p. 97).

Massachusetts—Very common about Cambridge (E. S. Morse, l.c.). Local and very gregarious at Westport (J. H. Thomson, Journ. of Conch., 1885, p. 372).

Michigan—Generally distributed throughout, and tabulated by Mr. B. Walker for eleven of the eighty-four counties into which the state is divided.

Minnesota—Belle Lake, Wright co., at roots of grass on crown of bogs, and in leaf-mould on banks of a small rill by Clearwater Lake (Sargent, Naut., 1895, p. 89).

New Jersey—Gloucester co. (W. J. Fox, Nautilus, 1891, p. 114).

New Mexico—Sacramento Mountains, Otero co., and at Clouderoft, James Cañon, at an altitude of 9,500 feet (E. J. Vanatta, Nautilus, Sept. 1902).

New York—Found in 1871 at Litchfield in Herkimer co. by Dr. Brown. Rare at Plattsburg, G. H. Hudson, 1885. East Onondago co., W. M. Beauchamp, 1885. Common in Cayuga Lake Valley (N. Banks, Nautilus, 1892, p. 138). Coldspring, Long Island (H. Prime, Nautilus, 1894, p. 70).

North Carolina—Roan Mts. (Walker and Pilsbry, Proc. Acad. Philad., 1902).

Ohio—Enumerated for Cincinnati by R. M. Byrnes.

Pennsylvania—Allegheny co. (Stupakoff, Nautilus, 1894, p. 135).

Rhode Island—Local and gregarious at Tiverton (J. H. Thomson, J. of C., l.c.).

Texas—Bosque co., H. W. Ericsson (Bland and Binney, Ann. N.Y. Lyc., 1874).

Geographical Distribution.—*Punctum pygmæum* in its aggregate form is very widely dispersed throughout the Holarctic realm. It is well distributed in Europe, being recorded for every country, and penetrating to the extreme north, while extending in the south into North Africa and the Atlantic Isles, eastwardly it reaches the confines of Asia, and is spread over the whole of North America.

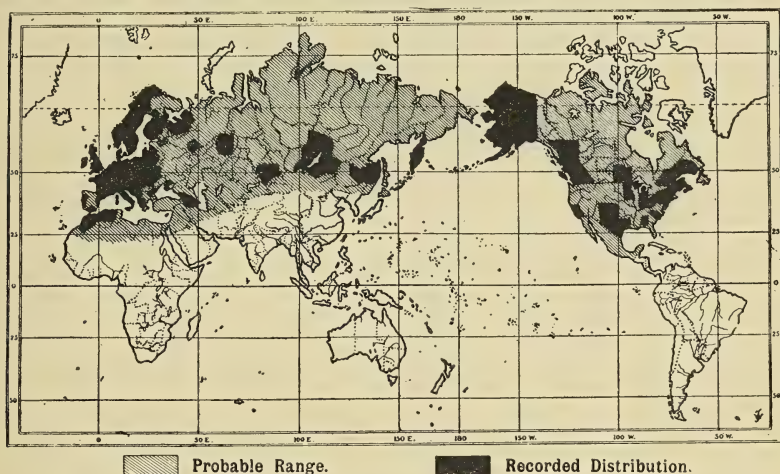


FIG. 224.—Geographical Distribution of *Punctum pygmæum*.

In the British Isles it is diffused over the whole country, extending to the Hebrides and the Orkney Islands, but has not yet been recorded for the Shetlands.

ENGLAND AND WALES.

Channel Isles—Recorded for Jersey by M. Duprey; and by Tomlin and Marquand as not uncommon at Moulin Huet, Grande Mare, Bordeaux, King's Mills, and the Gouffre, Guernsey! and also at Clanque in Alderney.

PENINSULA.

Cornwall W.—Land's End, Mr. Millett. Helston, May 1908! J. R. le B. Tomlin. In Whitsand Bay sand, Mr. Hennell (E. D. Marquand, Cornwall List, 1884, p. 5).

Cornwall E.—Plentiful on cliffs and old walls about East Looe, April 1909! A. H. Jowett-Murray.

Devon S.—Exeter, 1887, E. D. Marquand. Plymouth, Aug. 1891! F. Hughes.

Devon N.—Woods in North Devon, Dr. Jeffreys. Brendon Bridge, April 1908! A. H. Jowett-Murray. Lundy Island, Jan. 1907! J. R. le B. Tomlin.

Somerset S.—Yeovil (J. H. Ponsonby, Journ. of Conch., 1884, p. 246).

Somerset N.—Rejectamenta of river Brue, Glastonbury, O. Morland. Not uncommon on Cleveland and Elton Hills (A. M. Norman, Somerset List, 1860, p. 144).

CHANNEL.

Wilts. N.—Rejectamenta at Purton, near Swindon! Rev. J. Going.

Wilts. S.—Devizes (Brown, Ill. Conch., 1845, p. 79). Salisbury, Rev. J. E. Vize.

Dorset—East Lulworth, Kendall; Godlingston, Swanage, R. H. Soden-Smith; Stoborough; Houghton Stubbs and Whatcombe Park, J. C. Mansel-Pleydell. Charmouth, Guy Bredden. Portland! F. H. Sikes.

Isle of Wight—Hill-side, Totlands Bay! J. E. Cooper.

Hants. S.—Near Christchurch; in rejectamenta of the river Avon, also on Roeshot Hill and near Mudeford, Oct. 1881! C. Ashford. Garden, "Pheasantries," Hambledon, C. S. Coles. Chark Common, J. E. Cooper.

Hants. N.—Swarraton, Feb. 1888! Rev. W. L. W. Eyre.

Sussex W.—Ratham, near Chichester, Nov. 1881! W. Jeffery.

Sussex E.—Not uncommon at roots of grass, moss, etc., on the downs (W. C. Unwin in Merrifield's Nat. Hist. Brighton, 1860). Hassocks, Nov. 1901, P. F. Kensett. Cowfold near Horsham, W. Borrer. Downs about Lewes, Hurstmonceaux, and in Ashcombe plantation, and formerly found at Hastings, J. H. A. Jenner.

THAMES.

Kent E.—Folkestone, Jan. 1883 ! Mrs. Fitzgerald. Margate, Sept. 1885 ! S. C. Cockerell.

Kent W.—Brasted, Oct. 1905 ! Cobham Woods, March 1909 ! F. H. Sikes.

Surrey—Common in beech woods, Reigate (G. S. and E. Saunders). Among rushes, Barnes Common, Dec. 1885, T. D. A. Cockerell. In dry and cold weather may be found under stones and chalk fragments among grass on south slope of downs, Croydon, Kenneth McKean. Marden Park ! J. E. Cooper.

Essex S.—Among dead beech and holly leaves, Highbeach, Loughton, April 1888 ! H. Wallis Kew. Epping Forest, J. E. Cooper.

Essex N.—Occurs in considerable numbers in Stour Wood, Ramsey ; Glebe grove, Parsonage garden and lawn, in Wrabness, under stones and pieces of wood, as well sound as decayed (Rev. Revett Sheppard, Linn. Trans., 1825, vol. xiv., p. 162). Barfield, Felstead, not common, 1888 ! J. French. Farnham, E. G. Ingold.

Herts.—Tring, Oct. 1908 ! Charles Oldham.

Middlesex—Harefield, Yiewsley, and near Colnbrook ! J. E. Cooper.

Berks.—Under damp leaves in ditches, Maidenhead, July 1880 ! L. E. Adams. Numerous on cut reeds by Kennet and Avon canal, Burghfield Lock, Nov. 1906, Rev. E. Peake.

Oxford—Near Little Bourton, Banbury (Stretch, 1885). Rare on an old wall near Wood Eaton (Whiteaves, 1857). Common near Oxford, 1880 ! Rev. S. S. Pearce.

Bucks.—Round Cowper's Oak ; and at Olney, Nov. 1894, Lionel E. Adams. Burnham Beeches, 1908 ! J. E. Cooper and G. D. H. Carpenter.

ANGLIA.

Suffolk E.—"Found under stones between Baylham and Great Blakenham" (Rev. Revett Sheppard, Linn. Trans., 1825, vol. xiv., p. 162). Specimens in British Museum labelled "Yoxford." On a hedgebank, Woodbridge, Aug. 1890, L. E. Adams. Stoke Ash, Thwaite, Barham and common about Mendlesham ! A. Mayfield. Aldeburgh, J. E. Cooper.

Suffolk W.—Clare (Brown, Ill. Conch., 1845, p. 79). Sudbury (King) ; Bury St. Edmunds (Skepper) ; Hardwick (Rev. Churchill Babington) ; Hopton ! Knettishall, Walsham-le-Willows, Drinkstone, Haughley, Great Fakenham, and Rattlesden, A. Mayfield.

Norfolk E.—St. Faith's, and in sandpit on Ipswich road, J. B. Bridgman. Near Garboldisham, Nov. 1890, Lionel E. Adams. Earlham ! A. Mayfield.

Cambridge !—J. R. le B. Tomlin.

Northampton—Gayton, July 1881 ! A. Loydell. Castle Ashby and Yardley Chase, moderately common, 1893 ; and abundant from Brayfield to Billing, Feb. 1897 ! Lionel E. Adams.

SEVERN.

Gloucester E.—Stroud, plentiful, Aug. 1884 ! E. J. Elliott. Common in Birdlip Woods, Aug. 1892 ! Lionel E. Adams.

Gloucester W.—Neighbourhood of Bristol, J. S. Miller (Jeffreys, Linn. Trans., 1833, vol. xvi., p. 512). On walls, Redland, T. G. Ponton ; quarries on the downs, E. C. Wheeler and A. Leipner (Leipner, Bristol List, 1875, p. 287). Old walls near Westbury, Miss F. M. Hele. Long Wood, Frocester ! Chas. Upton.

Monmouth—Symond's Yat, Monmouth, etc., Aug. 1883, A. F. Griffith. Wynd Cliff, Chepstow, April 1909 ! F. H. Sikes.

Hereford—One specimen at Rotherwas (A. E. Boycott, Sci. Goss., 1892, p. 79).

Worcester—Under stones, Malvern. Specimens in the Worcester Museum, collected by Mr. G. Reece (Griffiths' Malvern List, 1870, p. 160).

Warwick—Sadai's Bridge, Solihull, 1865 ! W. Nelson. Knowle (G. Sherriff Tye, Q. Journ. of Conch., 1875, p. 69).

Stafford—Perry Barr (G. S. Tye, Q. Journ. of Conch., 1878, p. 69). Burford lane, Stafford, Nov. 1885, L. E. Adams. Woodhead, Cheadle, Jan. 1888 ! T. F. Burrows.

Salop—Church Stretton (Jeffreys, Ann. and Mag. Nat. Hist., 1855, p. 464).

SOUTH WALES.

Glamorgan—At roots of rushes in a piece of marshy ground at Marino, near Swansea (Jeffreys, Linn. Trans., 1830, vol. xvi., p. 343).

Brecon—Rhydygoch Falls, April 1909 ! F. H. Sikes.

Radnor—In moss, Cwm Bach dingle, Glasbury ! J. Williams Vaughan.

NORTH WALES.

Merioneth—Dolgelly, Aug. 1883, A. F. Griffith. Glan-y-Llyn, Sept. 1885 ! E. Collier.

Denbigh—Bodscallon Woods and Happy Valley, Great Orme's Head, July 1877 ! W. Denison Roebuck.

Flint—Mold, Sept. 1891 ! Rev. T. Shankland.

Anglesey—Llanfaes, Beaumaris, and sandhills, Llanfaelog, Aug. 1886 ! J. G. Milne.

TRENT.

Lincoln S.—Great and Little Ponton, July 1902 ! R. Worsdale.

Lincoln N.—Scauby, near Brigg, Sept. 1885 ! Thos. Rogers. Among chalk debris, Claxby near Alford, Sept. 1885 ! J. E. Mason. Burgh-on-Bain, and in parish of Sixhills, March 1896 ! W. Denison Roebuck. Hubbard's Valley, May 1887 ! H. Wallis Kew. Well, April 1890 ! J. Burt Davy. Sandhills, Mablethorpe, 1900, C. S. Carter. Common at Cadney, and rare at Kirton-in-Lindsey, May 1901, Rev. E. A. Woodruffe-Peacock.

Leicester and Rutland—Rare, Aylestone churchyard ; rejectamenta of Carlton brook, Rev. A. Bloxam (J. Plant, Leicester List, 1887, p. 28).

Notts.—Sparingly at Highfield House, and Stanton-on-the-Wolds (E. J. Lowe, Notts. List, 1853). Wood near Wollaton Colliery, 1879 ! rejectamenta, Carlton-on-Trent, and Colwick, 1883 ; High Park, Hucknall Torkard ! in coppices, Pleasley Vale, 1883 ; Lenton, 1883 ; Edwinstone, 1883 ; Widmerpool and Ruddington, 1883 ; Tollerton, Feb. 1884 ! Beauvale, Apr. 1884 ! C. T. Musson. Common, Thrumpton, Feb. 1885 ! B. Sturges Dodd. Amongst rejectamenta, Cresswell Crags, and at Mansfield, Apr. 1882 ! Edgar Pickard.

Derby—Cresswell Crags and Debdale, 1881 ! and Markland Grips, April 1882 ! E. Pickard. Matlock, July 1864, C. Ashford. Quarndon, Derby, Rev. G. W. Taylor. Lathkill Dale, Aug. 1891, R. Standen. Abbotsholme, Oct. 1906, F. H. Sikes.

JERSEY.

Cheshire—Knutsford Bog, Sept. 1885 ! T. Rogers. Owley Wood, Weaverham, abundant, Nov. 1900 ! B. R. Lucas. Minshull Vernon, Oct. 1902, C. Oldham.

Lancashire S.—Crosby, near Liverpool (Liverpool Nat. Scrap Book, 1863). Barlow Moor Wood ! J. Walkden. Southport, very rare, in damp places (McNicol, Southport List, 1861, p. 133). Church, near Acerrington, Sep. 1884, Conrad Gerland. Farington, Feb. 1889 ! W. H. Heathcote. Plentiful among grass, on the steep banks enclosing fields in the midst of Birkdale sandhills ; also found in Hesketh Woods, Scarisbrick, Rufford, and Bispham, G. W. Chaster.

Lancashire Mid—Lytham (E. J. Lowe, Notts. List, 1853). Lancaster (D. Dyson, Manchester List, 1850). Morecambe ! W. Nelson. Fleetwood, Sept. 1891, L. E. Adams. Caton and Brookhouse ; The Yealands ; Silverdale, 1904, J. W. Jackson.

HUMBER.

York S.E.—Scarce in lime quarries, Beverley Westwood, Sept. 1881 ; and at roots of furze on banks of Humber at Ferriby, Dec. 1878, J. Darker Butterell. Driffild, Feb. 1885 ! L. B. Ross. Weltondale and Drewtondale, Tom Petch. Brough, South Cave and Sledmere, 1891, F. W. Fierke. Quarry, Rudstone ; and Reighton, near Filey, Sept. 1905 ! W. E. Brady.

York N.E.—Saltburn Woods, Feb. 1887 ! B. Hudson. Scarborough, W. Bean. Musham Bank gate, in a small disused quarry by Seamer railway station, near Scarborough, Oct. 1896, Raincliffe Wood, Forge Valley, East Ayton Quarry, Nov. 1904, and Hackness, J. A. Hargreaves. Ryehills Farm, Marske ! Baker Hudson. Guisborough Woods, Rev. W. C. Hey.

York S.W.—Wentbridge and Brockerdale, May 1882 ! Denbydale ; Sandal Castle and Haw Park, G. Roberts. Common but local in all the woods about Huddersfield, J. Whitwham. Maple Dean Clough, and Park Wood, Elland, J. E. Crowther. Glass Houghton, March 1868 !

York Mid W.—Queen Elizabeth's walk, York (Backhouse) ; Askham and drift of river Ouse (H. Richardson) ; Collingham, Sept. 1873 ! and Towton, Nov. 1873 ! Holme Farm, Rigton, Oct. 1876 ! Pompoali and Brotherton, Apr. 1877 ! W. Nelson. Bardsey, Sept. 1872 (H. Shaw). Ledstone, G. Roberts. Allerton, Feb. 1883 ! W. West. Roundhay Park and limehills, June 1872 ! Holden Gill, Silsden, May 1908 ; and formerly common in Shipley Glen, but the flood of July 1900 altered the course of the stream and destroyed the locality, F. Booth. Wood near waterfall, Ingleton, Apl. 1885 ! W. West. Knaresbro' and Nidd Bridge, 1887 ! F. R. Fitzgerald. North Stainley, Ripon, and Hackfall woods, Apl. 1868 ! W. D. Roebuck.

York N.W.—Coverdale, Dec. 1887, R. C. Chaytor. Easby Abbey, near Richmond, Aug. 1881 ! W. Denison Roebuck.

TYNE.

Durham—Darlington (W. H. D. Longstaffe, Hist. of Darlington, 1854, p. 372). In quarry, West Thickley, near Shilton, 1884 ! B. Hudson. Common, Winston, Oct. 1902 ! B. R. Lucas.

Northumberland S.—Under decayed leaves in woods, not uncommon (Joshua Alder, Newcastle List, 1831, p. 36). Near Wylam (Brown, Ill. Conch., 1845, p. 79). Specimen labelled " Benwell," in Alder coll. ! Newcastle Museum.

Cheviotland—Twizel House (Thompson, 1840, p. 32). Among moss in damp place on Shortridge Links, near Alnmouth (G. R. Tate, Alnwick List, 1856, p. 115).

LAKES.

Westmorland and Lake Lancashire—Kendal (E. J. Lowe, Notts. List, 1853). Common in Eggerslack Wood, and by Meathop road, Grange, May 1907 ! on walls, Grange road, Cartmel, June 1903, F. Booth. Low Holker; south of Yewbarrow; in Charney Well lane, and Hagg's lane, Cartmel (H. Beeston, J. of C., 1908, p. 201).

Cumberland—Headsnook, on dead leaves in ditch (Miss Donald, Cumberland List, 1885). Bassenthwaite, near Keswick, June 1907 ! W. J. Farrer.

Isle of Man—Wall near Castleton, Aug. 1875 ! and at the foot of cliffs overlooking the sea, Glen Maye, Sep. 1891 ! The Curragh, June 1904 ! J. R. le B. Tomlin.

SCOTLAND.

WEST LOWLANDS.

Kirkcudbright—Near Castle Douglas ! W. Evans. Kippford and Dalbeattie, Jan. 1907 ! Rev. R. Godfrey.

Ayr—Ballantrae (Thompson, Ann. of N.H., 1840, p. 32). Skelmorlie ! A. Shaw.

EAST LOWLANDS.

Peebles—Rare, West Linton, Sept. 1893, W. Turner. Soonhope; Dawick and Standalane, near Peebles, July 1890 ! W. Evans.

Roxburgh—Elwand, near Melrose, Sept. 1893 ! Mrs. J. Carphin. Ellwyn, near Galashiels, very rare, J. Roseburgh.

Berwick—Boggy ground between Redhough and Fast-castle (G. Johnston, Proc. Berw. Nat. Club, 1838, p. 155). Ayton, May 1841 (Proc. Berw. Nat. Club, 1842, p. 246). Pease Dean, Oct. 1890 ! and near Eyemouth, Sept. 1895 ! W. Evans.

Haddington—Luffness ! Rev. J. McMurtrie. Gosford Woods ! W. Evans.

Edinburgh—Dalhousie Woods (Rhind's Edinb. List, 1836, p. 141). Rosslyn Glen (Brown, Ill. Brit. Conch., 1845, p. 79). Blackford Hill; Bush near Penicuik ! and roadside, Balerno, March 1890 ! W. Evans.

Linlithgow—Dalmeny, Sept. 1893 ! Mrs. J. Carphin.

EAST HIGHLANDS.

Fife and Kinross—Kinkell Braes ! and Earlshall near Leuchars ! W. Evans.

Stirling—Near Baldernock (Fauna and Flora of West of Scotland, 1876, p. 42). Drymen, June 1889 ! Alex. Shaw. Polmont ! W. Evans.

Perth S.—Pass of Leny, Callander, May 1889 ! W. Evans.

Perth Mid—Found in Glen Farg, and on Moncrieffie Hill (J. Dawson, Proc. Perth Soc., 1870, p. 18). Birnam Hill, F. Buchanan White.

Perth N.—Near Perth, Dec. 1884 ! H. Coates. Blairgowrie ! and Fenderbridge, foot of Glen Tilt, Sept. 1898 ! W. Evans. Kinnoull Hill (J. Dawson, l.c.).

Aberdeen S.—A fresh specimen found in shell-sand from mouth of river Ugie (Macgillivray, Moll. Aberdeen, 1843, p. 324).

Aberdeen N.—Loch Strathbeg, near Fraserburgh ! T. Scott.

Banff—Banff, T. Edwards (Jeffreys, Brit. Conch., v., 1869, p. 159).

WEST HIGHLANDS.

Main Argyle—Oban (Jeffreys, Brit. Conch., 1862, p. 223).

Dumbarton—Near Luss, Loch Lomond ! F. G. Binnie.

Clyde Isles—Loch Ranza, Isle of Arran ! and Skeoch Wood, near Rothesay, Isle of Bute, July 1889 ! Alex. Shaw. Ardmalish Point, June 1887 ! T. Scott.

Cantire—Ronachan, Jan. 1906 ! Rev. R. Godfrey.

NORTH HIGHLANDS.

Ross W.—Ullapool, Aug. 1886 ! Alex. Somerville.

Sutherland E.—Golspie Burn, June 1883 ! Loch Brora, Sept. 1888 ! W. Baillie.

Sutherland W.—In damp woods, east of Kyle of Tongue, July 1883 ! W. Baillie.

Caithness—Dunbeath, Oct. 1883 ! W. Baillie.

NORTH ISLES.

Hebrides—Balelone in North Uist, July 1905 ! J. Waterston.

Orkneys—Black Craig of Stromness, Mainland, Aug. 1905 ! Rev. R. Godfrey.

IRELAND.

ULSTER.

Derry—Common on decaying leaves in wood by railway at Ballycairn's Farm, near Coleraine, Sept. 1883 ! L. E. Adams. In "shell pockets" by side of river Bann; rejetaamenta of Burnfoot river, Feb. 1903, R. Welch.

Antrim—Moss shakings, Murlough, Sept. 1896, R. Standen. Bushfoot, 1898; and Black Mountain, Belfast, 1904, A. W. Stelfox. Whitepark Bay, Aug. 1901, B. R. Lucas. Ballycastle ! J. R. le B. Tomlin.

Down—Belvoir Park, Belfast, 1898; Lisburn, Aug. 1898; and Warren Point, 1905, A. W. Stelfox. Rookfield, Comber ! J. N. Milne. Groomsport, 1893 ! R. F. Scharff.

Armagh—Armagh, Dec. 1904 ! P. H. Grierson.

Monaghan—Inniskeen; Castleblayney, Nov. 1903; and Carrickmacross, Nov. 1905 ! P. H. Grierson.

Tyrone—Annahoe, Mr. Waller (W. Thompson, Ann. of Nat. Hist., 1840, p. 32).

Donegal—Rejectamenta at mouth of river Erne, July 1892, R. L. Praeger. Dunlewy; and in "shell pockets" at Carrickfinn; Mullaghderg and Horn Head, 1905; Cruit Island, Sep. 1908! A. W. Stelfox. Narin, July 1902! Miss A. L. Massy.

Fermanagh—Enniskillen and Marble Arch, 1900! A. W. Stelfox.

LEINSTER.

Louth—Dundalk, Dec. 1903! Darver, Jan. 1904! Ballymascaulon; Omeath! Inniskeen; Barmeath! Collon! Beaulieu! and Lough Drumshallon, Oct. 1904! Blackrock and Ravendale, Nov. 1904! Narrow Water! Flurry Bridge and Ballagan, Dec. 1904! Townley Park, Feb. 1905! Longwood; Nobber, March 1905; and Moynalty, April 1905, P. H. Grierson.

Meath—Near Trim, April 1905! and Siddan, March 1905! P. H. Grierson.

Dublin—Little river marsh, Killiney (Walpole, Zool., 1853). Rare under stones in marsh, Bushy Park, 1903! R. Welch and A. W. Stelfox. Clonard, Dundrum, Sept. 1893! R. F. Scharff.

Kildare—Coolcarrigan, 1907, A. W. Stelfox.

Wicklow—Glen of the Downs (W. Thompson, Annals of Nat. Hist., Sept. 1840, p. 32). Woodenbridge, March 1893, R. F. Scharff. Powerscourt Waterfall, Aug. 1904! P. H. Grierson.

Wexford—New Ross, Sept. 1907! R. A. Phillips.

Carlow—Borris, April 1903! P. H. Grierson.

Kilkenny—Ullard and Silverspring, 1903! Clogh! near Kilkenny! Kilbrohan! Callan! Gowran! Powerstown! Kilmanagh! Thomastown! Castle Comer! and Urlingford, P. H. Grierson.

Queen's Co.—La Bergerie, near Portarlinton, Rev. B. J. Clarke. Between Ballinakill and Durrow, May 1903! P. H. Grierson.

Westmeath—Raharney, Mar. 1905! P. H. Grierson. Rejectamenta of the river Shannon, Athlone, Sept. 1895, R. Standen.

CONNAUGHT.

Leitrim—Mohill, 1899; and Cloone! P. H. Grierson.

Sligo—Very rare in Rockwood and Glencar; and a few in "shell pockets," Strand Hill, R. Welch and A. W. Stelfox. Glencar, April 1906! B. R. Lucas. Sligo, April 1908, F. H. Sikes.

Mayo W.—Among moss in dry ditch, Dugort, Achill Island; and under stones on field walls near the "colony," Sept. 1888! J. G. Milne. Common at Delphi; also at Westport, April 1897! R. Welch.

Galway W.—Among moss, Inchangoil, Sept. 1885, R. Standen. Dog's Bay, Sept. 1906! and common at Cregduff and on Inishmacdara, but scarce at Ballynahinch, Sept. 1907, A. W. Stelfox. Roundstone, Sept. 1902, J. R. le B. Tomlin.

Galway E.—Kilbeg on shores of Lough Corrib, 1906! A. W. Stelfox. Amongst ground moss, Clonbrock, June 1896, R. F. Scharff.

MUNSTER.

Clare—Sparingly on sandhills, Miltown Malbay (W. Thompson, Annals of Nat. Hist., 1840, p. 32). Lahinch, 1900! P. H. Grierson.

Tipperary N.—Finnoe, E. Waller (W. Thompson, Ann. Nat. Hist., 1840, p. 199).

Tipperary S.—Ballingarry, June 1903, P. H. Grierson.

Waterford—Cappoquin, Nov. 1902! P. H. Grierson. In moss shakings, Glendine, July 1907! R. Welch and A. W. Stelfox.

Cork N.—Frequent about Whitegate and Glanmire, R. A. Phillips.

Cork S.—Macroom, June 1903, P. H. Grierson. In moss, Lough Allua; and under stones with *S. oblonga* at the Gearagh, July 1907! R. Welch and A. W. Stelfox.

Kerry—Woods near Inchiquin Lake, E. Collier. Torc Woods; near the Cascade, Killarney; and in rejectamenta of Muckross Lake, July 1898, G. W. Chaster. Derrynane, July 1892! R. F. Scharff.

GERMANY.

Diffused throughout the empire, and has been found in Alsace, Baden, Bavaria, Brandenburg, Coburg, Franconia, Hanover, Hesse, Holstein, Lippe, Lorraine, Luneberg, Magdeburg, Nassau, Oldenburg, West, East and Rhenish Prussia, Pomerania, Posen, Pyrmont, Saxony, Silesia, Suabia, Thuringia, Weimar, Westphalia, Wurtemberg, and the Islands of Rugen, Usedom, and Wollin.

NETHERLANDS.

Holland—Reported by Heer Schepmann as existing in Gelderland, Limburg, North Holland, South Holland, and Utrecht; and collected by M. van den Broeck in May 1871 on the canal-side between Selzaete and Sluys-Kill in Zeeland.

Belgium—*P. pygmaeum* has been observed in the provinces of Antwerp, Brabant, West Flanders, Liège, Limburg, and Luxemburg, and is also known from the Grand Duchy of Luxemburg.

FRANCE.

Found throughout the whole country, and has been recorded from the following districts or departments :—Ain, Aisne, Allier, Alpes Maritimes, Ardennes, Aube, Auvergne, Basses Pyrénées, Bouches-du-Rhône, Calvados, Côte d'Or, Gard, Gers, Gironde, Haute Garonne, Hautes Pyrénées, Haute Savoie, Hérault, Isère, Landes, Loire Inférieure, Lot, Lot et Garonne, Lozère, Morbihan, Moselle, Nièvre, Nord, Oise, Puy de Dôme, Rhône, Saône-et-Loire, Sarthe, Savoy, Seine, Seine-et-Marne, Somme, Var, Vaucluse, Vendée, Vienne, Vosges, Yonne, and Corsica.

SWITZERLAND.

Apparently well distributed over the country, and has been recorded from Aargau, Berne, Geneva, Glarus, Grisons, Neuchâtel, Valais, Vaud, and Zurich.

ITALY.

Probably diffused throughout the peninsula and islands; it has been recorded from the provinces of Calabria, Campania, Emilia, Lombardy, Piedmont, Tuscany, Venetia, and the Island of Sicily.

AUSTRO-HUNGARY.

Recorded from almost all the countries constituting the empire, viz. :—Austria, Bohemia, Carinthia, Croatia, Dalmatia, Hungary, Istria, Galicia, Moravia, Transylvania, and the Tyrol.

BALKAN PENINSULA.

Greece—Only known from Corfu, from whence it is recorded by Dr. Boettger.

Montenegro—Reported by Mr. G. K. Gude from Pridivoyi.

Bulgaria—Recorded by Dr. Kobelt.

Bosnia—Recorded by Dr. Boettger from Nemila in Central Bosnia.

SPAIN AND PORTUGAL.

Spain—Recorded from Barcelona in Catalonia by Bofil; and as rare in the Island of Minorca by Prof. Hidalgo.

Portugal—Recorded by Morelet for Cintra in Estremadura; and from Oporto in Minho by da Silva.

SCANDINAVIA.

Norway—Diffused over all Norway, from the North Cape to the extreme south.

Sweden—Extends over the whole country, from Qvickjock in Lulea-Lappmark to Skane in the extreme south, and also exists on the Island of Gothland.

Denmark—Dr. A. C. Johansen reports that *P. pygmaeum* probably inhabits the whole of Denmark, but has been only actually verified to exist in Viborg Stift in East Jutland, the Islands of Zealand, Funen, and Bornholm.

RUSSIA.

P. pygmaeum is widely dispersed over European Russia, but the records are as yet few. It has, however, been noted as found in Archangel, Courland, Crimea, Lapland, Livland, Moscow, Pern, Poland, and St. Petersburg, and Luther cites it from fifteen of the twenty-seven districts into which he has divided Finland.

In Transcaucasia it is noted from Borschom, Kasbek and Manglis in the government of Tiflis, and from Helenendorf in Elizabetpol.

SIBERIAN SUB-REGION.

Siberia—*P. pygmaeum* is quoted by Westerlund for Eastern Siberia, and it has been specially cited for Kultuk on Lake Baikal, for the Altai region, and for the Valley of the Amour.

Kamtschatka—Tabulated for this peninsula by Dr. Westerlund.

NORTH AFRICA AND ATLANTIC ISLES.

Algeria—Perfectly characteristic shells found near Bône by M. Letourneux.

Morocco—Recorded by Pallary for Tangiers, and for Tetuan by Mr. Ponsonby.

Madeira—Quoted by Watson as an inhabitant.

Azores—(Reeve, British Mollusks, 1863, p. 86).

NEARCTIC REGION.

British North America—*P. pygmaeum minutissimum* is recorded from British Columbia, Manitoba, and Quebec.

United States—*P. pygmaeum minutissimum* is recorded from Alaska, Alabama, California, Colorado, Indiana, Iowa, Maine, Massachusetts, Michigan, Minnesota, New Jersey, New Mexico, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, and Texas.

Distribution of *Punctum pygmæum* (Drap.).

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.





Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilts N.	48 Merioneth
8 Wilts S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid
21 Middlesex	NUMBER
22 Berks.	61 S.E. York
23 Oxford	62 N.E. York
24 Bucks.	63 S.W. York
ANGLIA	64 Mid W. York
25 Suffolk E.	65 N.W. York
26 Suffolk W.	TYNE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Hunts.	69 Westmorland
32 Northampton	and L. Lanes
SEVERN	70 Cumberland
33 Gloucester E.	71 Isle of Man
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	83 Aberdeen N.
73 Kirkcudbright	84 Banff
74 Wigtown	85 Elgin
75 Ayr	86 Easternness
76 Renfrew	W. HIGHLANDS
77 Lanark	97 Westernness
E. LOWLANDS	98 Main Argyle
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Pth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

-  Probable Range.
-  Recorded Distribution.
-  Distribution verified by the Author.
-  Geological Distribution.

SUB-FAMILY HAPLOGONA Pilsbry.

This group is, like *Polyplacognatha*, composed of unspecialized and primitive types, which have in course of ages become diffused over the whole surface of the globe, but which now only retain their ancient dominancy in the extreme southern extensions of the great land masses of the earth, the great central desert region of North America, New Zealand, Tasmania, the southern portions of Australia, and islands of the Pacific Ocean, in all of which places they are comparatively free from the competition of the more highly organized and recently evolved Helicidian groups.

Haplogona is a new term used to define the Helicoid shells possessing simple and unreflected lip margins, and characterized by the mandible being composed of over-lapping and partially soldered laminae, or of segments completely fused, the lines of fusion being indicated by vertical striation. The teeth show no special peculiarities, except that the inner cusp is retained on the laterals, as in *Pupidae*, and the genitalia are notable only for the simplicity of its arrangements, and the very low insertion of the spermatheca duct.

The sub-family has been divided into two groups, based upon the absence or assumed presence of the caudal mucus gland, the genera *Endodonta* and *Pyramidula* belonging to the former group.

GENUS *PYRAMIDULA* Fitzinger, 1833.

Following Dr. Pilsbry, the term *Pyramidula* is used in preference to *Patula* of Held and other names, all of which it antedates. This group, which embraces *P. rotundata*, *alternata*, etc., consists of dull-coloured, ground-loving snails, which are diffused over the whole north temperate land area. Its nearest relatives are *Charopa*, *Trachycystis* and *Stephanoda*, which occupy the south temperate regions of Australia, Africa, and South America respectively.

All these genera may be regarded as the scattered remnants of an early fauna, partially dispossessed in some regions where they were formerly dominant by the higher and more recently-evolved groups.

The ANIMAL shows an undivided SOLE, and very long and slender OMMATOPHORES; the GENITALIA lack all accessory organs; the DUCT of the SPERMATHECA is very long; the HERMAPHRODITE DUCT is also very elongate and strongly convoluted; and the RETRACTOR MUSCLE is attached at or near the distal end of the PENIS-SHEATH, where the VAS DEFERENS also enters.

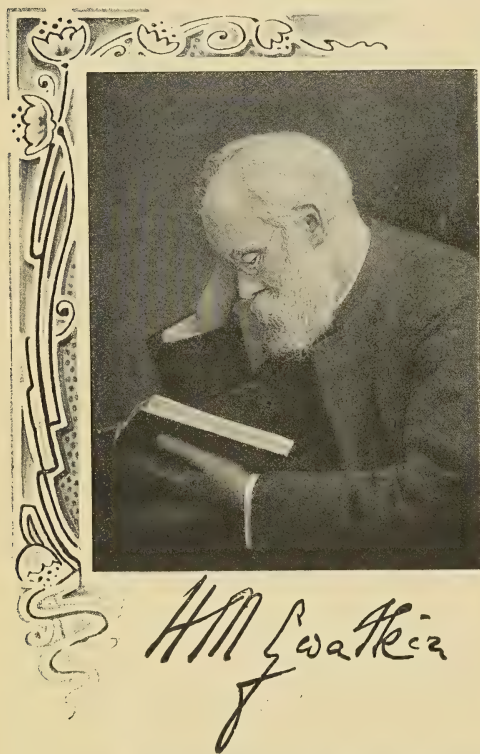
The JAW is arcuate, its component parts fused together, the lines of fusion often indicated by slightly divergent striation.

The RADULA shows a central obscurely tricuspid tooth, the side-cusps being indicated by a slight sinuation; the laterals are bicuspid, and lack endoconic points, differing thus from *Trachycystis*, *Charopa*, etc.; the marginals with low wide basal plates, the inner portion bearing two cusps, the outer margin becoming multicuspid by the splitting of the cusps.

The SHELL varies in contour from a conoidal to a flattened and disc-like shape, is usually opaque and unicolorous; the WHORLS subcylindrical or keeled with rib-striate sculpture, and spirally banded or flammulated; the APEX generally smooth. APERTURE lunately-rounded, with a thin and simple margin.

Pyramidula rupestris (Draparnaud).

- 1801 *Helix rupestris* Draparnaud, Tabl. Moll., p. 71, no. 4.
 1801 — *pusilla* Vallot, Exerc. d'Hist. Nat., p. 5.
 1803 — *umbilicata* Montagu, Test. Brit., p. 434, pl. 13, f. 2.
 1821 — *saxatilis* Hartmann, Syst. Gast., p. 52.
 1841 — *aliena* Ziegl., Pfeiffer's Symb., pt. 1, f. 39.
 1841 — *spirula* Villa, Disp. Syst. Conch., p. 56.
 1855 — (*Hygromane*) *rupestris* Moq.-Tand., Hist. Nat., ii., p. 192, pl. xv., ff. 10-13.
 1826 *Helicella rupestris* Risso, Hist. Nat. Eur. Mér., iv., p. 69.
 1833 *Pyramidula rupestris* Fitzinger, Syst. Verz., p. 95.
 1833 *Turbo myrmecidis* Scacchi, Osserv. Zool., i., p. 11.
 1837 *Patula rupestris* Held, Isis, p. 916.
 1837 *Euryomphala umbilicata* Beck, Ind. Moll., p. 9.
 1840 *Delomphalus saxatilis* Hartmann, Gast. i., p. 122, pl. 37, ff. 4-6.
 1840 *Zonites umbilicatus* Gray's Turton, Brit. Shells, p. 166, pl. 5, f. 4-5.
 1852 — *rupestris* Leach, Syn. Moll., p. 74.



HISTORY.—*Pyramidula rupestris* (*rupestris*, rock-loving) is a very distinct species, and was first discriminated by Studer, who applied to it the name of *Helix rupestris*, in the Fauna Helvetica, published in 1789 as an Appendix to "Coxe's Travels in Switzerland," but he gave no description or figure.

Draparnaud described the same species in 1801, adopting Studer's name, thus antedating Colonel Montagu, who in 1805 applied the name of *Helix umbilicata* to the British specimens of the same shell.

This little rupicolous species is here associated with the Rev. Prof. H. M. Gwatkin, M.A., D.D., of Cambridge University, who has devoted his attention to a study of the molluscan radula, of which he possesses one of the finest and most complete collections in existence. No one is more intimately identified with the progress of our knowledge of the dental structure

of our British species, and it is from his exquisite preparations of the mandible and radula of the present species that the illustrations of these organs have been drawn.

Diagnosis.—Though having much of the aspect of *P. pygmaeum*, this species is readily distinguished by its much larger size, more elevated spire, and uniform and more opaque dark-brown colouring. From the young of *P. rotundata* it differs in its uniform dark colouring and more risen spire; the latter species being very flat above, with transverse rib-like striae and carinate periphery.

Original Description.—" *Helix rupestris*. Coquille brune, torse ; spire élevée, ouverture ronde, ombilic évasé. Haut. 2 mill., larg. $2\frac{1}{2}$ mill., diam. $2\frac{1}{4}$ mill. Habite France méridionale sur les rochers élevés (4 tours). Animal noirâtre, plus pâle en dessous. Tentacules supérieurs courts, gros et très-obtus ; inférieurs à peine visibles à la loupe et semblables à de petits tubercules. Il redresse sa coquille, et la porte très-élevée, lorsqu'il marche."—DRAPARNAUD, Tabl. Moll., 1801, p. 71.

Description.—ANIMAL slate or dark-grey in colour with sometimes a reddish tinge, and covered with minute flattened TUBERCLES ; the sides covered with numerous minute black specks, which are arranged in squares and form rather large spots ; MANTLE dusky-brown, indistinctly speckled with black ; FOOT rounded in front, bluntly-pointed behind ; OMMATOPHORES divergent, dark grey in colour, thick and cylindrical, with large oval bulbular extremities ; the lower pair are almost rudimentary and nearly black.

SHELL subconical, more depressed beneath, rather solid, glossy and dark-brown in colour, marked with close-set transverse striæ, which encircle the whorls ; PERIPHERY rounded, but angulated in young shells ; WHORLS 4-5, cylindrical ; SPIRE somewhat raised ; APEX rather glossy and transparent ; SUTURE deeply impressed ; APERTURE deeply lunate, but compressed and without an internal rib ; OUTER LIP inflected, thin, simple, and slightly reflected in fully-adult specimens ; UMBILICUS large, open, and deep, exposing all the internal spire.

Diam. 3 mill. ; alt. 2 mill.

INTERNALLY, the REPRODUCTIVE ORGANS are described by Moquin-Tandon as showing a blackish HERMAPHRODITE DUCT ; the PENIS-SHEATH as rather thick and not elongate, with a distinct and blunt swelling, which represents the flagellum at the distal-end, where the VAS DEFERENS also enters, slightly dilating before its entry therein ; SPERMATHECA oblong, borne upon a long stem, but destitute of a copulatory branch ; the DART-SAC and MUCUS GLANDS are also absent.

The BUCCAL BULB is about a millimetre in length.

The JAW is, according to Moquin-Tandon, about a third of a millimetre in width from side to side, slightly arcuate from back to front, and well and strongly arched, but difficult to distinguish amongst the tissues owing to its colour and transparency, although slightly tinged with amber along the thickened upper margin, the anterior surface presents fourteen to twenty somewhat indistinct flattened ribs, perceptible as faint delicate vertical striation, which slightly crenulate the lower or cutting margin.

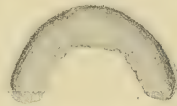


FIG. 226.—Jaw of *P. rupestris* $\times 75$. Teignmouth, S. Devon (prepared by Prof. Gwatkin).

The LINGUAL RIBBON is of the usual elongate shape, and composed of about 150 obliquely sinuate transverse rows of teeth, each row formed by a trifid central tooth with a long and powerful mesocone ; there are about eight distinctly bicuspidate laterals, each with a thick mesoconic reflection and a more insignificant ectocone, which tends to be laterally bifurcate ; the marginals are similar in character, about ten in number, and are only indicated by the change in the direction of the transverse row to which they belong, as the modification in the character of the teeth is almost imperceptible until the almost shapeless extreme marginals are reached.

The formula of a Grange specimen, prepared by Prof. H. M. Gwatkin, is $\frac{1}{2}^0 + \frac{8}{2} + \frac{1}{3} + \frac{8}{2} + \frac{1}{2}^0 \times 150 = 5,550$.

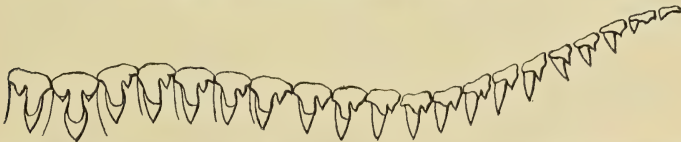


FIG. 227.—Half a transverse row of the teeth of *Pyramidula rupestris*, highly magnified, Grange (from a preparation by Prof. H. M. Gwatkin).

Reproduction and Development.—No observations have been made and nothing is known concerning the details of the conjugation of *P. rupestris*, but it is well recognized as one of our few ovo-viviparous species.

This ovo-viviparity is well established, and examples have been frequently found in their usual haunts by many observers from August to October, containing from three to seven embryos each ; these embryonal

shells, when within the matrix, always possess before exclusion about a whorl-and-a-half completely formed, are depressed in shape, of a dull-horn colour, and immediately at birth are quite able to forage for themselves.

M. Gassies has, however, recorded the deposition during May of about thirty very small, round, yellowish-opaline eggs by this species, but this statement has not been confirmed and may well be attributed to some error of observation.

Habits and Habitat.—*P. rupestris* is a mollusk said to secrete an abundant mucus when crawling, but is sluggish and inert during the day, though becoming more active on the approach of evening or after rain. It is a true rock-snail and displays a marked preference for calcareous rocks, though by no means confined to them, as it is occasionally found on schists, granite and felspathic rocks on the continent, and on millstone grit, sandstones, quartzose conglomerate, slate, etc., in this country.

It is very gregarious, living in numerous colonies, adhering during the day by means of a thin membranous epiphragm to the walls of buildings, etc., or to bare and bleak rock surfaces, fully exposed to the hot summer sun and all other climatic vicissitudes, a mode of life which has been regarded as a probable cause of the white and bleached appearance of the upper whorls of the shell. In this country, it however more often lives in the crevices of rocks, on the tops of walls and beneath loose stones, among the refuse in old quarries, etc., usually frequenting dry places more or less lofty and exposed, attaining in the Pyrenees to the zone of which the rhododendron is characteristic, at an elevation of 5,000 to 6,500 feet, and on the Pic du Midi reaching 9,000 feet. It has also been found by Mr. Edward Collier at an altitude of over 7,000 feet in the Valais, and by Dr. Cavanna at over 9,000 feet in Abruzzi.

Geological Distribution.—PLEISTOCENE.—Found by Mr. Blackmore in the brick-earth of Fisherton near Salisbury in South Wilts.

HOLOCENE.—*P. rupestris* is recorded by Kennard and Warren as found in a carbonaceous silt of probably Roman age, disclosed by excavations in Tooley street, Bermondsey, Surrey.

In Denmark, the specimens recorded by Elberling from the calcareous tufa of Neder Knaberup in Ribe Stift, Jutland, have been shown by Dr. A. C. Johansen to be *Acanthinula aculeata*.

Variation.—This species displays a great difference in form, ranging from an almost planorbular spire to a greatly elevated form with almost dislocated whorls, which has its metropolis in the Isles of the Ægean Sea.

According to Reeve, there is a characteristic analogue very similar in habit and character in *Helix saxicola*, a native of Cuba and Texas.

Var. *umbilicata* Montagu.

Helix umbilicata Montagu, Test. Brit., 1803, p. 434, pl. 13, f. 2.

Helix saxatilis Hartmann, Syst. Gast., 1821, p. 52.

Helix spirula Villa, Disp. Conch., 1841, p. 56.

Helix rupestris var. *convexa* Menke, Syn. Moll., 1830, p. 10.

Helix rupestris var. *subdepressa* Goupil, Moll. Sarthe, 1835, p. 17.

Helix rupestris var. *depressa* Westerlund, Fauna Eur., etc., 1876, p. 38.

SHELL with spire only slightly elevated; UMBILICUS more open.

This, the depressed form of the species, is more especially prevalent in the north of Europe, the bulk of the British specimens probably being referable to it; the spire becoming more elevated as the southern range increases.



FIG. 228.—*P. rupestris* v. *umbilicata* Montagu, natural size and enlarged (after Bourguignat).

Somerset N.—Wall, Cranmore, 1888 ! G. K. Gude.

Sussex E.—Ratton near Willingdon, 1888 ! G. K. Gude.

Sligo—Near Ballina, Oct. 1888 ! Mrs. Knox.

France—Recorded from the Hérault by M. Dubrueil ; from Mont d'Or and alluvium of the Rhône near Lyons by Locard ; from Mont Roland and Mont Guerin in Jura by Wattebled.

Switzerland—Bad Serneus, 1885 ; Chur, 1887 ; Upper Engadine, etc., in the Grisons (Am Stein, Grisons List, 1890, p. 22).

Italy—Recorded as var. *spirula* by Spinelli from Brescia and other localities in Lombardy ; as var. *saxatilis* from Piedmont by Lessona ; and by Paulucci as found in 1878 by Dr. Cavanna at Caramanico in Abruzzi.

Austro-Hungary—Found plentifully about Cracow in Galicia by Jachno ; and recorded as var. *spirula* from the South Tyrolean hills by Strobel.

Greece—Recorded by Stussiner and Boettger from Burbulitza in Thessaly, from Volo and the Peak of Osso.

Transcaucasia—Recorded by Dr. E. von Martens from Borschom in the government of Tiflis.

Var. *conoidea* Bourguignat, Mal. Alger., 1864, i., p. 185, pl. 16, ff. 31–33.

Helix rupestris var. *rupicola* Stabile, Prosp. Sist. Stat. Moll. Lugano, 1850.

Helix rupestris var. *elevata* Westerlund, Faun. Eur., 1876, p. 33.

Patula rupestris var. *dalmatina* Clessin, Mal. Bl., 1887, p. 51.

Helix rupestris var. *conica* Benoit, Ill. Sist. Crit., pl. v., f. 3.

SHELL globosely conoid, diameter slightly exceeding height ; UMBILICUS smaller.

This variety, formerly distributed under the name of *Helix scotica* by M. Bourguignat, is intermediate between the typical *rupestris* and the var. *trochoides* of Férussac.

Isle of Man—Niarbyl, Aug. 1893 ! R. Cairns.

Switzerland—Sub-var. *rupicola*, Serneus Bad, above the Kurhaus, 1885 ; plentiful at Bergel (Am Stein, Swiss List, 1890).

Italy—Sub-var. *rupicola* enumerated for Piedmont by Prof. Lessona ; and for Palermo and other places in Sicily by Benoit.

Austro-Hungary—Sub-var. *dalmatina* recorded by Clessin from rocks above the source of the Jedrobachs and in the Valley of Cettina, near Almissa, Dalmatia.

Algeria—Abundant at Constantine on the rocks of Bou-Mérid, attaining a diameter of $3\frac{1}{2}$ mill. and an alt. of 3 mill. ; rock crevices at Bougie (Bourg., l.e.).

Var. *trochoides* Férussac, Tabl. Syst., 1822, p. 44, pl. 80, f. 3.

Helix rupestris var. *meridionalis* Issel, Bull. Mal. Ital., 1870, p. 115.

Helix rupestris var. *chorismenostoma* Blanc, Faun. Mal. Grèce, 1878, p. 32.

SPIRE greatly produced, the height of the shell exceeding its diameter ; WHORLS subsealariform, and sometimes even partially dislocated.

This remarkable variety seems to be the prevalent form on the Island of Syra and neighbouring parts of Greece, and has also been recorded from other places.

England—On walls at Islip, Oxfordshire, in 1881, with typical form ! Rev. S. Spencer Pearce.

France—Férussac records the type specimens as found by Comm. Dufour at Castelnan, near Montpellier, in the Hérault, and Mr. G. K. Gude reports its occurrence in Vacluse.

Italy—Reported from Tuscany by Signor del Prete, near the Cave of Binelli, Carrara, and by M. Paulucci from Lucca in the upper valley of the Serchio. M. Paulucci also records this form as found at Carmanico, Abruzzi, in 1878, by Dr. Cavanna ; and states its occurrence at Palizzi in Calabria ; at Cape S. Elia near Cagliari in Sardinia, and as var. *meridionalis* at Monte S. Angelo in Umbria ; in which province it was also found at Avellana, in 1878, by Dr. Cavanna.

Greece—Stussiner and Boettger record the var. *chorismenostoma* from Syra, Demioas, Messeniën, the Peloponnesus and Mt. Macolessos, Boeotia.



FIG. 229.—*P. rupestris* var. *conoidea* Bourg., natural size and enlarged (after Bourguignat).



FIG. 230.—*P. rupestris* v. *trochoides* Férussac, enlarged (after Férussac).

Var. *viridescenti-alba* Jeffreys, Brit. Conch., 1862, vol. i., p. 221.

SHELL greenish-white.

Gloucester W.—Clifton near Bristol, Mr. Webster (Jeffreys, l.c.).

Pembroke—Wall by Penally station, Rev. H. Milnes.

Galway W.—Specimens of a trochoid form found on a wall under trees near Kiltonan, Inishmore Island, and Ross, Sept. 1906, G. W. Chaster.

Monst. *sinistrorsum* Taylor.

SHELL sinistrally coiled.

France—Cited by Moquin-Tandon on the authority of Moitessier, amongst the species of which sinistral forms are known.

Geographical Distribution.—*P. rupestris* is distributed throughout Central and Southern Europe, and extends as far as Sicily and Algeria.

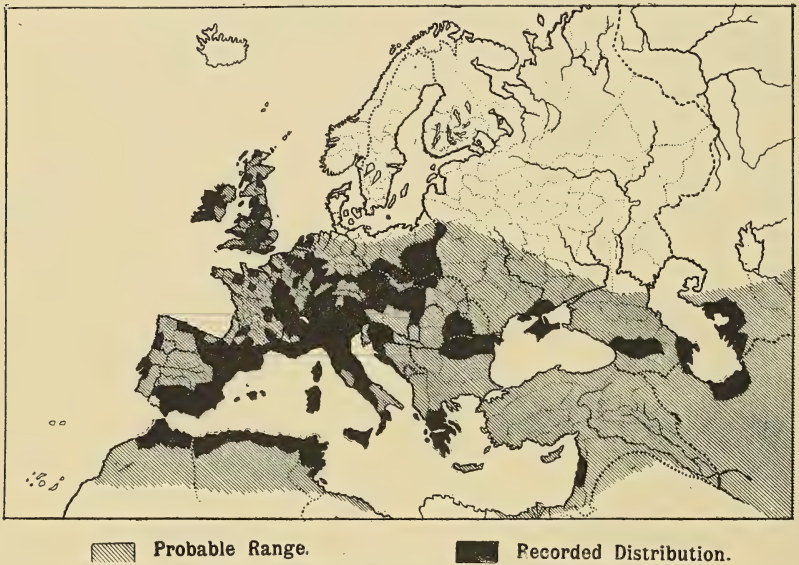


FIG. 231.—Geographical Distribution of *Pyramidula rupestris*.

In the British Isles the species is somewhat erratically distributed over the whole kingdom, its occurrence probably in most cases indicating the outcrop of limestone rocks.

ENGLAND AND WALES.

Channel Isles—On walls, Grande Havre, Vale, Guernsey, July 1885 ! (Tomlin and Marquand, Journ. of Conch., 1903, p. 87).

Cornwall W.—Falmouth, Jan. 1886 ! J. H. James. Included doubtfully for Mount's Bay by Mr. E. D. Marquand (West Cornwall List, 1884, p. 5).

Cornwall E.—Lanteglos by Fowey, June 1887 ! C. P. Richards. On old wall, West Looe, April 1909, A. H. Jowett-Murray.

Devon S.—Torquay, Oct. 1884 ! Mrs. Oakeshott. Plymouth, abundant, May 1885 ! C. G. Barrett. Teignmouth, Sept. 1888 ! Loftus St. G. Byne.

Somerset N.—Common in crevices of limestone rocks on Clevedon and Elton Hills; Cleeve Toot; St. Vincent Rocks; Wrington Hill; Cheddar Cliffs, etc. Often exceedingly abundant among rotten mortar of old walls, as behind the Royal Hotel, Clevedon, and in many parts of the Mendips (A. M. Norman, Somerset List, 1860). Cheddar, Aug. 1884 ! J. Madison. On old walls, Bath, June 1886, Miss Fairbrass. Yeovil, J. H. Pensonby.

CHANNEL.

Wilts. N.—Under the tiles of Laycock Abbey and Lackham House (Montagu, Test. Brit., 1803, p. 435). Walls near Corsham (J. E. Vize, Wilts. Mag., 1866, p. 279). Great Bedwyn (Townsend), and Melksham, 1905 ! E. W. Swanton.

Wilts. S.—Very abundant between Freshford and Westwood, Salisbury, Clarendon, Atworth, and Bath road, Devizes (J. E. Vize, Wilts. Mag., 1866, p. 279). Salisbury, 1905 ! E. W. Swanton.

Dorset—Abundant under loose stones on summit of hill on Portland Island, and on the top of Corfe Castle (Montagu, Test. Brit., 1803, p. 434). On every stone wall in Purbeck ; stone walls, Puncknowle, and Houghton Stubbs (J. C. Mansel-Pleydell, Dorset List, 1898, p. 7). Abundant, Durlstone Bay, Swanage, Aug. 1884 ! C. Ashford. Ruins of Corfe Castle, Aug. 1904 ! A. Russel Wallace. Lulworth, Aug. 1884 ! S. C. Cockerell.

Isle of Wight—Yaverland, A. G. More ; abundant on the walls of Carisbrooke Castle, 1909 ! Frank Morey.

Hants. S.—Old stone wall by Priory Church, Christchurch, Nov. 1884 ! Beaulieu Abbey, Aug. 1885 ! and on tombstones and church walls, Brockenhurst, Aug. 1885 ! C. Ashford. Castle grounds, Porchester, Aug. 1905, F. H. Sikes. Winchester, Aug. 1884 ! S. C. Cockerell. Common on old walls, Hambledon, C. S. Coles. Warblington, Southampton, C. E. Wright.

Sussex W.—Ratham ! W. Jeffery. Common on old flint walls, Shoreham, and in similar places throughout the district, Aug. 1883 ! R. Miller Christy.

Sussex E.—Very local about Brighton, W. C. Unwin, 1860. Among moss on walls of Compton Place, Eastbourne, J. H. A. Jenner. Southeram near Lewes, 1883 ! C. H. Morris. Hastings Castle, R. Tate. Common on wall at Alfreton, Sept. 1881 ! Rev. S. S. Pearce. On the north side of Churches at Horsham and Keymer, and on old walls, Lewes, W. Borrer.

THAMES.

Kent E.—Precincts of Cathedral, Canterbury, Feb. 1885 ! L. B. Ross.

Kent W.—Introduced into Chislehurst district in 1884 by Mr. T. D. A. Cockerell.

Surrey—Under stones, etc., Mickleham, summer 1837 (D. Cooper, London List, 1838).—“Kingston-on-Thames, W. R. McNab” (note in ms. Catal. Brit. Shells, Edinburgh Museum). Haslemere (C. Pannell, Journ. of Conch., 1902, p. 171).

Essex S.—Two shells only, in brushwood among decaying leaves at Carswell, Barkingside (H. Crouch, Essex Nat., 1890, p. 210).

Essex N.—Saffron Walden (note in ms. Catal. Brit. Shells, Edinburgh Mus.).

Herts.—Sandridge, Dec. 1883 ! A. F. Griffiths. Near Bushey Lodge, John Hopkinson.

Berks.—Common on walls on Fyfield road, near Oxford, 1880 ! Rev. S. S. Pearce.

Oxford—Churchyard wall, Minster Lovell, 1875 ! W. Whitwell. Woodeaton ! Rev. A. M. Norman. Abundant on walls at Islip, Aug. 1883 ! Rev. S. S. Pearce. On old walls beneath moss at Banbury ; common at Chipping Norton ; Weston-on-the-Green ; Bicester, Rev. A. Matthews ; common at Oxford (W. E. Collinge, Conch., 1891, p. 23).

ANGLIA.

Cambridge—Cherry Hinton, Aug. 1885, A. F. Griffiths.

Northampton—Plentiful after rain on walls, Gayton, Aug. 1882 ! A. Loydell. Milton near Peterborough, Aug. 1882 ! T. W. Bell. Roekingham Park, May 1896, Lionel E. Adams.

SEVERN.

Gloucester E.—Abundant on the rocks and stone walls about Cheltenham (Leach, Syn. Moll., 1852, p. 75). Leckhampton, Birdlip, and Cooper's Hill, April 1866 ! W. Nelson. Stroud, Sept. 1884 ! E. J. Elliott.

Gloucester W.—Bristol, in dry rocky situations (J. S. Miller, Ann. Phil., May 1822, p. 379). Rocks by Clifton Bridge, May 1866 ! W. Nelson. Bourton, Feb. 1888 ! Rev. W. L. W. Eyre. Amberley near Stroud, Aug. 1884 ! E. J. Elliott.

Monmouth—Common in the county, E. J. Lowe, Dec. 1886. Wynd Cliff, Chepstow, April 1909 ! F. H. Sikes.

Hereford—Abundant in rock crevices, etc., Doward Hill (A. E. Boycott, Sci. Goss., Apr. 1892, p. 79). Railway bank, Staunton-on-Arrow (Boycott and Bowell, Herefordshire List, 1899, p. 29).

Worcester—Myriads on a flag-covered roof, Evesham, Sep. 1885 ! R. D. Darbishire.

Warwick—Edge Hill, 1892 ! J. Madison.

SOUTH WALES.

Glamorgan—Abundant on and about Cardiff Castle, Oct. 1885 ! F. W. Wotton. Limestone walls, Parkmill, Gower, 1901, H. R. Wakefield.

Brecon—Clydach Falls, April 1909 ! F. H. Sikes.

Carmarthen—Walls of Dryslwyn Castle ! T. W. Barker.

Pembroke—First discovered by Montagu in great profusion on the loosely-built walls enclosing the fields on the north side of Tenby; it is still abundant about Tenby on limestone walls and in quarries. Common on garden walls, Penally, 1901, H. R. Wakefield. Giltar! J. E. Cooper.

Cardigan—Old castle, Aberystwyth, July 1907! C. H. Moore.

Carnarvon—Conway Castle walls, July 1883! W. Denison Roebuck. NORTH WALES.

Denbigh—Walls at Bodscallan! common on the summit of Great Orme's Head and Gloddaeth Mountain, July 1883! W. Denison Roebuck. Common at St. Asaph and on a wall at Denbigh road, March 1888, Lionel E. Adams. Llandudno, Sept. 1907, F. H. Sikes.

Flint—Mold! Rev. T. Shankland.

Anglesey—Near Plas Newydd, also in Penmon Park and Quarries, and on Puffin Island, Aug. 1883! John Hopkinson. On stone walls, Beaumaris, Sept. 1881, Lionel E. Adams. Red Wharf and Arthur's Round Table, May 1905, F. H. Sikes. Penrath, J. E. Cooper.

Lincoln S.—Wall at Great Ponton, near Grantham, July 1902! R. Worsdale. TRENT.
Leicester and Rutland—Rare, at foot of rocks on Mount Sorrell; and on abbey walls (Plant, Leicester List, 1887, p. 28).

Notts.—Not uncommon in the county (B. S. Dodd, Brit. Ass. Hdbk., 1893, p. 73).

Derby—Abundant in crevices of exposed limestone rocks, Matlock, June 1864! Chas. Ashford. Miller's Dale, Cheedale, Wormhill, and Castleton, April 1884! W. West. Buxton! J. Ray Hardy. Very plentiful on shaded rocks, Haddon Hall, 1879! C. T. Musson. Lathkill, Aug. 1891, R. Standen. Dovedale, Sept. 1880! W. Nelson. Tideswell, Aug. 1886; also on walls, Winster, Aug. 1889! L. E. Adams. MERSEY.

Cheshire—Scarce, Navigation Cop, Chester (Shrubsole, Chester List, 1884, p. 104).

Lancashire W.—Poulton, near Morecambe, June 1883! W. West. Worton, 1888! R. Standen. Easegill Beck, alt. 900 feet, Apr. 1887! W. Denison Roebuck. On wall, Bolton-le-Sands, Aug. 1903, H. Beeston. HUMBER.

York S.E.—Hessle, May 1889, Alfred Harker.

York N.E.—Vale of Mowbray, W. Grainge, 1859. Common on stones on the slopes of Hawnby Hill, Ryedale, Aug. 1884! W. Denison Roebuck.

York S.W.—Abundant on the top stones of walls about Elslack, Broughton, and Carlton, May 1908! F. Booth.

York Mid W.—In Wharfedale: Widely distributed throughout the Upper Valley, and has been recorded from Arneliffe, 1878! Rev. W. C. Hey. Abundant on walls in Grass Wood, Grassington, Aug. 1881, George Roberts. Kettlewell! Hubberholme! Deepdale! Littondale! Yockenthwaite! and Kilnsey Crag, Aug. 1882! also on the scars above Rakes Wood, Buckden, at an altitude of 1,800 feet, May 1886! W. Denison Roebuck. Burnsall! and Threshfield, 1875! W. Nelson. On walls of bridge and elsewhere about Ilkley, 1872! H. Shaw. On walls, Bolton Abbey to Droughton, 1890, H. T. Soppitt.

In Airedale: The species is quite restricted to the western highlands. Malham! (G. H. Parke, Nat., 1866, p. 88). Cracoe, April 1881! T. W. Bell. Bell Busk! Airtion! and Jennet's Cave! Aug. 1882, W. Denison Roebuck. Skipton, Jan. 1883! and Gordale, alt. 1,000 feet, June 1883! W. West. Gargrave, 1883 (Soppitt and Carter, Nat., 1888, p. 101).

In Lunedale: Found at Crina Bottom, Ingleton, July 1886! H. Shaw. Clapham, and slopes of Whernside and Ingleborough, March 1883! W. West.

In Ribblesdale: It exists on Giggleswick Scars, May 1887! at Settle, May 1892! W. D. Roebuck. Horton-in-Ribblesdale, and slopes of Penyghent, Sep. 1878! W. West.

York N.W.—In Lunedale: It has been found at Dovecote Gill, near Sedburgh, Aug. 1887! Baker Hudson. Dent Head, May 1892! W. Denison Roebuck.

In Wensleydale: It is well distributed upon walls and old buildings, and recorded among many other places from Hawes, June 1879! H. Pollard. Coverdale, 1887! R. C. Chaytor; and from Leyburn Shaw! Bolton Castle! Aysgarth! Stallingbush! High Bleas! Marsett! and Cubeck near Worton, Aug. 1882! W. Denison Roebuck. Carperby! H. Crowther.

In Swaledale: Barf Hill, Gunnerside! on walls about Satron and Keld! and in Arkengarthdale, July 1884! W. Denison Roebuck. Kisdon, 1891! R. Barnes. TYNE.

Durham—Very abundant in old quarries near the sea at Marsden (J. Alder, Newcastle List, 1830, p. 35). Common at Byer's Quarries, Marsden! (W. D. Sutton, Q. Journ. of Conch., 1., p. 27, 1874). Langdon Beck, Aug. 1889! J. E. Mason.

LAKES.

Westmorland and Lake Lancashire.—Kent's Bank, near Grange-over-Sands, 1870, W. H. Broadhead. Walls, Hagg's lane, Cartmel; also Fell road, Cartmel road, Spring Bank road, Windermere road, Allithwaite road, on the walls of the Hampsfell Hospice, in Eggerslack Woods, on the church wall, Grange; and at Lower Meathop, Aug. 1908, H. Beeston. Churchyard walls at Windermere, Bowness, and Troutbeck; also on the Brockram at Burrels, near Appleby (Miss Donald, Cumberland List, 1882, p. 59). Kendal (Jeffreys, Brit. Conch., 1862, p. 222). Fell End, Witherslack, April 1884! W. Denison Roebuck. Wall tops, Hackthorpe, June 1892 (J. C. Varty-Smith, Sci. Goss., July 1893, p. 159).

Cumberland—Abundant on the limestone, Bothel and Castle Carrock (Miss Donald, Cumberland List, 1882, p. 59).

Isle of Man—Very common on sea-walls on the south of the island; abundant on the walls about Castleton, Aug. 1875! and Scarlet Point, July 1880! W. Nelson. Common on old walls at Port St. Mary, Fleshwick, Poolvash, Glen Helen, and along Peel road, Douglas, Aug. 1892, W. Moss and R. Cairns.

SCOTLAND.

EAST LOWLANDS.

Edinburgh—On wall at west end of Duddingston Loch, May 1872! W. Evans.

EAST HIGHLANDS.

Perth Mid—Hill of Moncrieffe (J. Dawson, Proc. Perth Soc. Nat. Sci., 1870, p. 18).

Perth North—Not uncommon on the cliffs, Kinnoull Hill! Henry Coates.

WEST HIGHLANDS.

Main Argyle—Ardbhairn Crags, Oban! W. H. Heathcote.

Clyde Isles—On the Isle of Arran near the summit of Ceim-na-Cailich on the Ranza side of the Garbh-Chorie, and at a similar altitude on Blein Gaodh (Leach, Syn. Moll., 1852, p. 75).

NORTH HIGHLANDS.

Sutherland W.—Durness, Mr. Peach (Jeffreys, Brit. Conch., 1869, v., p. 159).

IRELAND.

ULSTER.

Antrim—Garron Point, common, 1906! Ballygally Head! R. Welch. Island Magee, 1903! A. W. Stelfox. Gobbins, Island Magee! J. N. Milne.

Monaghan—Abundant, Carrickmacross, Oct. 1903! and Lagan Bridge, Nov. 1904! P. H. Grierson.

Donegal—Abundant, Rockville, alt. 50 ft., Aug. 1889! J. G. Milne. Bundoran, April 1908! F. H. Sikes.

Fermanagh—Locality not given! R. Welch.

Cavan—Mount Nugent and Gorn Hull, Feb. 1906! P. H. Grierson.

LEINSTER.

Louth—Dundalk and Drogheda, Dec. 1903! P. H. Grierson.

Meath—Rejementa of river Boyne, Navan, July 1888! W. F. de V. Kane. Inchamore Bridge, Nov. 1905! south of Lake Bullihoe, and about Duleek, June 1905! Summerhill and Bullivor, March 1905! near Carlum Church, April 1905! Mornington and Primetown, June 1905, P. H. Grierson.

Dublin—Numerous, Balbriggan, June 1905! P. H. Grierson. Specimens in the British Museum, labelled "Dublin"!

Kildare—Near Monastereven, July 1893! R. F. Scharff.

Wexford—New Ross, Oct. 1907! R. A. Phillips.

Carlow—Tinnahinch, Mch. 1909! R. A. Phillips. Borris, Mch. 1895! R. F. Scharff.

Kilkenny—Along the Dublin road near Kilkenny, April 1902! Jenkinstown! Ardaloo! Attanagh! Silversprings! and Thomastown! P. H. Grierson.

Queen's Co.—La Bergerie, Rev. B. J. Clarke. Durrow, May 1903! P. H. Grierson.

King's Co.—In crevices of a mossy stone, Clonooney Barracks (Brown, Wern. Mem., 1818, p. 525). Edenderry, Nov. 1905! P. H. Grierson.

Westmeath—Knockcross, Derrevaragh Lake, June 1886! W. F. de Vismes Kane. Multyfarnham, G. P. Farran. Raharney, Mch. 1905, P. H. Grierson.

CONNAUGHT.

Roscommon—Rathkeery, alt. 250 feet, Aug. 1889! J. G. Milne.

Leitrim—Plentiful on a limestone wall, Dromahaire, Sept. 1900! R. Welch. Common on limestone walls, Ballinamore, 1899, P. H. Grierson.

Sligo—Ballina! Mrs. Knox. Generally distributed on limestone; abundant on some dry stone walls at Rosses Point, Raghley, Carrowmore, Lissadill, Glencar, Swiss Valley, and on cliffs, Gleniff Cave (Welch and Stelfox, Irish Nat., 1904, p. 187).

Mayo E.—Lough Carra, July 1906! R. L. Praeger. Edmondstown near Ballyghaderreen, alt. 200 ft., Aug. 1889! J. G. Milne.

Mayo W.—On stones lying on the beach a few feet above high-water mark at end of quay, Westport; and on walls by roadside, Aug. 1886! J. G. Milne.

Galway W.—Abundant on South Isles of Aran, June 1834 (W. Thompson, Ann. and Mag. Nat. Hist., 1840, p. 206). Plentiful on rocks and walls, Ballyvaughan and Aranmore (R. Standen, Irish Nat., 1905, p. 26). Abundant and generally distributed, but not found west of Ballinahinch, Sep. 1907, A. W. Stelfox. Barna, Aug. 1907 ! R. A. Phillips.

Galway E.—Crevices of old limestone walls, Clonbrock, June 1896, R. F. Scharff. MUNSTER.

Clare—Common, but confined to the limestone districts; Lahinch ! Ennis, and Corofin, P. H. Grierson. Lough Rhask, Ballyvaughan, Aug. 1894 ! E. Collier. Edenvale, July 1905, R. Welch. Inchiquin Lake, Aug. 1907 ! R. A. Phillips.

Limerick—Abundant, Limerick, Dec. 1886 ! W. Hill Evans. In beechwood, adjoining old churchyard, Galbally, Nov. 1898 ! Miss A. L. Massy.

Tipperary N.—Finnoe, E. Waller. On carboniferous limestone walls, between Moalfeld House and Redwood Castle, June 1906, Rev. E. A. Woodruffe-Peacock. Borrisokane, Aug. 1907 ! R. A. Phillips.

Tipperary S.—Grantstown, June 1885 ! Richard Rimmer. On wall of tow-path near Clonmel ! and near St. Patrick's Well, Apr. 1888, Rev. A. H. Delap. Farranrory, Jan. 1902 ! and near Clonmel, May 1903 ! P. H. Grierson.

Waterford—Mount Ambrose ! Cappoquin, Nov. 1902 ! Dungarvan, Dec. 1902 ! and on walls, Mount Congreve, Jan. 1902, P. H. Grierson. Ardsalla, July 1907 (Welch and Stelfox, Irish Nat., 1907, p. 280).

Cork N.—Aghada, Doneraile, and Ballyphenane (Welch and Stelfox, Irish Nat., 1907, p. 280). Youghal, Miss Mary Ball. Cork, May 1885 ! Rev. J. W. Horsley. Liscarrol, Oct. 1902 ! Youghal, Aug. 1902 ! Middleton, Sept. 1902 ! Fermoy and Castletownroche, P. H. Grierson.

Cork S.—Large colonies upon the patches of mud on the rock-face of an old limestone quarry between Carrigrohane and Ballincollig, Aug. 1888 ! Major Frere. The Gearagh (Welch and Stelfox, Irish Nat., 1907, p. 280).

Kerry—Tore Waterfall, Killarney ! J. R. Hardy. Common on walls by Mucksna Wood ; fairly common at Aghadoe, Sep. 1898, Lionel E. Adams. Common at Clady, Sheen, Killowen, and throughout the limestone district about Kenmare ; off the limestone area, it occurs chiefly on limestone walls as at Muckcross, July 1898 (R. Standen, Irish Nat., Sept. 1898, p. 221).

GERMANY.

H. rupestris has only been recorded from Alsace, Lower Baden, Upper Bavaria, Upper and Lower Franconia, Nassau, Rhenish Prussia, Silesia, and Wurtemberg.

NETHERLANDS.

Holland—Reported from North Holland by Heer Schepmann.

Belgium—Colbeau reports this from Aerschot in Brabant, and doubtfully from Forest near Brussels, while Van den Broeck has found it at Hastière. It is reported from Namur and Dinant by Colbeau ; and from Genbloux by Broeck.

FRANCE.

This species is found in the departments or provinces of Ain, Allier, Ariège, Alpes Maritimes, Aube, Aude, Auvergne, Basses Alpes, Bouches du Rhône, Calvados, Côte d'Or, Gard, Haute Garonne, Hautes Pyrénées, Haute Savoie, Hérault, Ille et Vilaine, Isère, Jura, Lot et Garonne, Lozère, Meuse, Nièvre, Pyrénées Orientales, Rhône, Saône-et-Loire, Sarthe, Savoy, Seine-et-Marne, Somme, Var, Vaucluse, Yonne, and the Island of Corsica.

SWITZERLAND.

Widely distributed throughout the country, and is reported from the cantons of Aargau, Appenzell, Berne, Geneva, Glarus, Grisons, Lucerne, Neuchâtel, St. Gall, Ticino, Uri, Valais, and Vaud.

ITALY.

Recorded from the provinces of Abruzzi, Calabria, Campania, Emilia, Liguria, Lombardy, Marches, Piedmont, Tuscany, Umbria, Venetia, and the Islands of Sicily and Capri.

SPAIN AND PORTUGAL.

Spain—Apparently diffused over the whole peninsula, being known from Andalusia, Asturias, Aragon, Catalonia, Old Castile, Murcia, Navarre, Valencia, and is common on the upper regions of the rock of Gibraltar. It is also known from Majorca and Minorca, Balearic Isles, and is common at San Julia de Loria, Andorra.

Portugal—Recorded from Lisbon, Cintra, Mengo, Leiria, etc., in Estremadura, and by A. da Silva from Oporto in Minho, and Condeixa in Beira.

Distribution of *Pyramidula rupestris* (Drap.)

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilts N.	48 Merioneth
8 Wilts S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid
21 Middlesex	HUMBER
22 Berks.	61 S.E. York
23 Oxford	62 N.E. York
24 Bucks.	63 S.W. York
ANGLIA	64 Mid W. York
25 Suffolk E.	65 N.W. York
26 Suffolk W.	TYNE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Hunts.	69 Westmorland
32 Northampton	and L. Lanes
SEVERN	70 Cumberland
33 Gloucester E.	71 Isle of Man
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	83 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easternness
76 Renfrew	97 Westernness
77 Lanark	98 Main Argyle
E. LOWLANDS	99 Dumbarton
78 Peebles	100 Clyde Isles
79 Selkirk	101 Cantire
80 Roxburgh	102 Ebudes S.
81 Berwick	103 Ebudes Mid
82 Haddington	104 Ebudes N.
83 Edinburgh	N. HIGHLANDS
84 Linlithgow	105 Ross W.
E. HIGHLANDS	106 Ross E.
85 Fife & Kinross	107 Sutherland E.
86 Stirling	108 Sutherland W.
87 Pth. S. & Clkn.	109 Caithness
88 Mid Perth	NORTH ISLES
89 Perth N.	110 Hebrides
90 Forfar	111 Orkneys
91 Kincairdine	112 Shetlands
92 Aberdeen S.	

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

BALKAN PENINSULA.

Greece—Diffused throughout the mainland and the islands, and recorded for Nauplia, Morea; Lykabettos near Athens, Attica; Peristori in the Mountains of Pindus, Albania; the province of Thessaly; the Islands of Eubœa and Corfu, the Northern Sporades, the Cyclades and Cephalonia among the Ionian Islands.

Roumania—Rahova (Clessin, Mal. Bl., 1886, p. 185).

AUSTRO-HUNGARY.

Distributed over the country, and recorded from Austria, Bohemia, Carinthia, Carniola, Croatia, Galicia, Hungary, Illyria, Moravia, Transylvania, and Tyrol.

SCANDINAVIA.

Denmark—Dr. Johansen states that *P. rupestris* is quite absent from Denmark, though Schlessch, probably in error, has recorded it from Bornholm.

RUSSIA.

P. rupestris is at the present time only known from the Crimea, Poland, and from the provinces of Baku, Colchis, Kutais, and Tiflis in Transcaucasia.

SIBERIAN SUB-REGION.

Siberia—In Transcaspia, it is recorded by O. Rosen from Schamhala, Soulouklou, Germab, and Kasandshik.

ASIA MINOR, ETC.

Persia—Recorded from Kopet and Küren-dag, Chorassan, by Baron Rosen.

Syria—Found on the rocks in the Valley of Nahr-el-Kelb near Beyrout (Bourguignat, Mal. Alger., 1864, vol. i., p. 24).

NORTH AFRICA.

Morocco—Recorded from Tetuan and Tangiers by Kobelt and Pallary.

Algeria—Recorded by Letourneaux for Kabylia, and by Morelet for Cirta.

Tunis—Letourneaux and Bourguignat record this species as in the country between Calle and Cape Roux, also at Porta-Farina and Fourn-el-Goubel.



FIG. 232.—The dry river valley above Malham Cove, Yorkshire. The carboniferous limestone scars are a characteristic habitat of *Pyramidula rupestris*. (Photographed by Mr. Godfrey Bingley).

SUB-GENUS *Discus* Fitzinger.***Pyramidula rotundata* (Müller).**

- 1692 *Cochlea terrestris compressa, maculata, et leviter striata* D. Dale, Lister, Hist. Conch., App., tabl. 4, gen. tab. 1058, fig. 11A.
 1695 *Planorbis hortensis minima, pulchre striata* Petiver, Gazophylacion, tab. 31, fig. 5.
 1712 *Cochlea parva magis compressa umbilicata quinque spirarum pullo et subflavo colore eleganter tessellata, striis capillaribus transversè depicta* Morton, Northamp., p. 416, ch. 17.
 1742 *Cochlea terrestris depressa et umbilicata, albida, fascia punctata rufa per medium anfractuum et maculis concoloribus eleganter depicta* Gualtieri, Conch., I., tab. 3, fig. Q.
-
- 1774 *Helix rotundata* Müller, Verm. Hist., ii., p. 29, no. 231.
 1778 — *radiata* Da Costa, Brit. Conch., p. 57, pl. 2, ff. 33, 34.
 1828 — *turtoni* Fleming, Brit. Anim., p. 269.
 1855 — (*Delomphalus*) *rotundata* Moquin-Tandon, ii., p. 107, pl. 10, ff. 9-12.
 1833 *Discus rotundatus* Fitzinger, Syst. Verz., p. 99.
 1837 *Patula rotundata* Held, Isis.
 1837 *Euryomphala rotundata* Beck, Ind. Moll., p. 9.
 1840 *Zonites rotundatus* Gray, Turton's Man., p. 165, pl. v., f. 44.
 1852 — *radiatus* Leach, Syn. Moll., p. 74.
 1893 *Pyramidula rotundata* Pilsbry, Manual of Conchology, part 33, p. 46.



A. Moquin-Tandon

HISTORY.—*Pyramidula rotundata* (*rotundata*, rounded) has been known from the earliest times, having been noticed by Lister, Petiver, and other of the older writers, but was first binomially distinguished by Müller in 1774.

It belongs to the section or sub-genus *Discus* of Fitzinger, which is characterized by its depressed spire, convex or rounded whorls, and their conspicuous rib-striation; a feature most developed upon the upper surface and within the umbilicus.

Some systematists place *Pyramidula rotundata* in the section *Gonyodiscus* of Fitzinger, which differs from *Discus* in the periphery of the whorls being sharply and distinctly angulated, but Fitzinger himself defined the allocation of this species.

This beautiful little species is associated with Prof. A. Moquin-Tandon, of Toulouse, the accomplished author of

the elaborate work on the Land and Freshwater Mollusca of France, which, although published over a half-century ago, is still the most esteemed authority upon the land and freshwater mollusca of that country.

The *P. brocciana* and *P. cupaniana* of Calcare are said by Reinhardt to be founded upon young shells of *P. rotundata*, and according to Dr. Pilsbry the genus *Allergya* was established by M. Bourguignat upon embryonic shells of this species.

Diagnosis.—*P. rotundata* is sufficiently distinguished from any other British species by the strong transverse sculpture of the whorls and their reddish flammular blotches. From its fossil ally *Pyramidula ruderata* it is differentiated by its more depressed form; more numerous, more slowly increasing and more angulated whorls; the reddish fleckings, and smaller mouth.

Description.—ANIMAL comparatively small, slaty-grey in colour, darker on the back and paler towards the foot, and finely sprinkled with black at the sides; TUBERCLES rather large and flat; MANTLE reddish-grey, marked with very close and distinct milk-white dots; TENTACLES dark grey; OMMATOPHORES closely approximating with stout bulbous extremities; FOOT rather narrow.

SHELL almost discoidal, but more depressed above than below; WHORLS six or seven, slowly and regularly increasing, subcylindrical in shape, but with a sub-angulate periphery; of a yellowish-brown colour, moderately opaque and glossy, and ornamented with a regularly placed series of rufous flames or blotches, which often alternate with those of the preceding whorl; the sculpture consists of curved transverse ribs, of which there may be 120 or more on the last whorl, with finer intermediate striae, which encircle the whorls and are only slightly stronger on the upper side; SUTURE well marked; MOUTH transversely ovaliform, with a sharp and thin peristome, which is reflected basally and slightly inflected above; UMBILICUS extremely wide, open, and deep, exposing all the internal spire; EPIPHRAGM very thin, whitish, and semitransparent.

Diam. 7 mill.; alt. 3 mill.

INTERNALLY, the HEART lies well within the penultimate whorl adjacent to the aperture; it is comparatively small and contracts rapidly.

The NERVOUS SYSTEM has the component GANGLIA of the NERVE-RING noticeably more open and distinct, and the connectives and commissures longer than is usual amongst the true *Helices*, this open character allowing the buccal mass at will, to be protruded beyond or withdrawn within the NERVE RING; the CEPHALIC GANGLIA

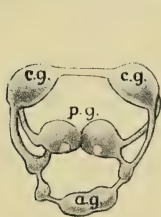


FIG. 234.



FIG. 235.



FIG. 236.

Nervous, muscular, and circulatory organization of *Pyramidula rotundata*, highly magnified.

FIG. 234.—Brain-ring, with otocysts, of *Pyramidula rotundata*, $\times 25$. c.g. cephalic ganglia; p.g. pedal ganglia, showing otocysts; a.g. combined abdominal and right visceral ganglia.

FIG. 235.—Cephalic and pedal retractors of *Pyramidula rotundata*, $\times 10$. om. ommatophore retractors; lt. f. lower tentacular retractors; f. subsidiary foot retractors; p. pharyngeal retractor.

FIG. 236.—Renal organ or kidney and heart of *Pyramidula rotundata*, $\times 10$, showing also the looping of the intestinal canal by the cephalic branch of the aorta. k. kidney; a. auricle; v. ventricle.

are large and distinct, joined by a long commissure; the PEDAL GANGLIA show the dull-white otocysts which are large for the size of the animal on the middle of their posterior faces; the VISCERAL GANGLIA show the usual constituents, those on the right side being largest, and the right pallial ganglion is fused with the abdominal ganglion.

The CEPHALIC RETRACTOR becomes trifid at about one-third of its length, the MEDIAN MUSCLE being affixed to the BUCCAL BULB and not dividing at the point of fixation; the paired TENTACULAR RETRACTORS each give off early a powerful slip to the FOOT, and dividing again later to send a slender muscle to the lower tentacles.

The SUPRA-PEDAL GLAND is comparatively well developed, and occupies nearly all the hinder part of the foot, but is quite deficient of the roof folds, so conspicuous in many species. This is also one of the few species in which pigment cells are found mingled with the gland cells, while behind and above the gland there is a large and well-defined BLOOD-SINUS or lacuna.

The REPRODUCTIVE ORGANS of *Pyramidula rotundata* display the simplicity characteristic of the *Haplogona*, being deficient of dart, flagellum, and mucus glands; the whitish OVOTESTIS is composed of acini arranged in a long and narrow series, and is imbedded in the DIGESTIVE GLAND; the white HERMAPHRODITE DUCT is very long, much enlarged, and closely convoluted in the middle, terminating at the base of the conspicuous RECEPTACULUM-SEMINIS which is cleft at the apex and slightly pigmented; the ALBUMEN GLAND is narrow, almost lanceolate, and of a brown colour tinged with green; the SPERM-DUCT or prostate is very broad, covered with elongate, loosely adherent, opaque, milk-white nodules, apparently charged with lime; OVIDUCT yellowish-grey, moderately ample, and sacculate; free oviduct narrow and direct; the PENIS SHEATH, which is looped by the retractor of the right ommatophore, is very large, massive, and white, with the distal end abruptly deflected or bent; the stout PENIAL RETRACTOR being attached to the convex side and to the oviduct; VAS DEFERENS simple, and entering the penis sheath at its distal extremity; SPERMATHECA whitish, elongate-oval, with a very long and slender blackish stem without a diverticulum; ATRIUM short.

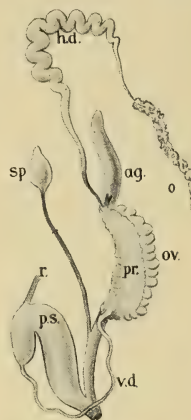


FIG. 237.—Reproductive organs of *P. rotundata* $\times 5$.
h.d. hermaphrodite duct; o. ovotestis; a.g. albumen gland; ov. oviduct; v.d. vas deferens; r. retractor; p.s. penis sheath; sp. spermatheca; pr. prostate.

The JAW or mandible is about half-a-millimetre in width from side to side, and only slightly arched, with a blunt and slightly-projecting median beak or rostrum; narrow and with upper and lower margins almost parallel the whole length, and showing very indistinct and delicate intermediate striation; pale amber in color, becoming colourless and almost transparent along the upper margin; numerous delicate vertical folds indistinctly crenulate the cutting-edge, but do not reach the upper margin, while a lesser number but stronger and more decided in character, arise from the upper margin, and usually extend across the jaw to the cutting-edge; the ends are slightly rounded with the lower angles acute.

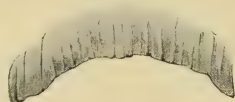


FIG. 238.—Mandible or jaw of *Pyramidula rotundata*, $\times 50$.
(Kilmanock, Wexford, Mr. G. Barrett-Hamilton; preparation by Mr. J. W. Neville).

The RADULA is of the usual oblong shape, and consists of about one hundred sinuately transverse rows, each row composed of a rather long and narrow tricuspid mid-tooth, bearing a strong mesocone with a rather insignificant ectocone at each



FIG. 239.—Half a transverse row of teeth from the radula of *P. rotundata*, highly magnified, Kilmanock, Wexford (Mr. G. Barrett-Hamilton; preparation by Mr. J. W. Neville).

side; the laterals are bicuspid, being deficient of the endocone, but possess a strong and obliquely directed mesocone and a comparatively small ectocone; the marginals, which are seven or sometimes eight in number, are tricuspid, displaying in addition to a large and powerful mesocone and a strong ectocone, a closely appressed and insignificant endocone, which becomes more distinct as the margin is approached.

The dental formula of a Kilmanock specimen is $\frac{7}{5} + \frac{8}{2} + \frac{1}{1} + \frac{8}{2} + \frac{7}{5} \times 100 = 3,100$.

Reproduction and Development.—No details are known of the congress of this common species, except that during conjugation the seminal matter is probably transferred in a fluid condition and not by means of a spermatophore or capreolus.

The process of egg deposition probably commences as early as February, and is continued quite to the end of the year. The eggs to the number of twenty or thirty, are laid among or beneath rubbish, dead leaves, etc., and at the foot of trees, in little clusters, containing eight, ten, or even fifteen eggs each, and are small, white, opaque and ellipsoidal, nearly a millimetre in their longest diameter, the ratio of the two diameters being about the same as those of the tawny owl. They hatch in ten or twelve days, the young and immature shells differing from the adults in being quite flat above and very convex beneath ; they become adult in about a year.

Pyramidula rotundata is perhaps liable to produce alien offspring, as Mr. H. Beeston has observed it in coition with *Hyalinia alliaria* ; while Dumont and Mortillet remark that at Sommier au Reposoir in Savoy many individuals are found quite intermediate in character between the present species and *P. ruderata*, which are probably true hybrids, as both species are found intermixed there.

Habits, Food, etc.—*Pyramidula rotundata* is slow, apathetic, but somewhat sensitive, and is an ubiquitous species in many parts of the country, frequenting almost indiscriminately nearly every variety of situation. It is said to be the commonest of the smaller Helicidiform species on the greensand formation and is also abundant on the chalk.

P. rotundata is crepuscular or nocturnal in habit, but may be found during the day, secreted beneath stones, dead leaves, loose or decaying bark or timber laid on the ground, or even on dry mud banks or among stoneheaps by the roadsides. It may also be discovered on or at the foot of old stone walls, in old quarries, or woodstacks amongst turf or moss, at roots of nettles, or amongst ivy and decaying hedge-trimmings, by stream-sides, in dry or wet places indifferently, and even invading the precincts of buildings and damp outhouses, where it sometimes attains a large size ; indeed, it is scarcely possible to imagine a situation capable of sustaining molluscan life where it may not be found.

Though so accommodating in its requirements, this species is said in France to prefer places with a northern or eastern aspect, but this is probably not the case in more sunless countries.

It lives at almost all altitudes, from the lowland plains to the alpine heights, but, according to Prof. Forbes, not ascending in Switzerland beyond the zone of dwarf pines, while in the Pyrenees Dr. Fischer records it from the zone of the rhododendron at altitudes between 5,000 and 6,500 feet.

Among its enemies, blackbirds and starlings are well known as feeding readily upon it, many shells having been found in their crops.

Little or nothing is known of the food preferred by this species ; it has been said to devour dead and decaying leaves and even decaying wood, while in wet places it frequents and perhaps feeds upon *Equisetum telmateia*.

In captivity, Dr. Gain offered at different times to colonies of this species 194 different kinds of food, but of this large number none were

devoured with avidity, and only the following fungi and edible cultivated plants were readily eaten :—*Agaricus procerus*, *Boletus edulis*, *Russula emetica* and *R. heterophylla*, the leaves and stalks of cabbage and lettuce, the foliage of the leek and onion, and the roots of carrot and radish ; a few other kinds were sparingly eaten or only nibbled after some abstinence from food.

Geological Distribution.—This species, though so abundant in the recent state within its distributional area, has not been found lower than the Miocene.

MIOCENE.—In France, Dr. Scharff records this species from the freshwater deposits near Bordeaux, Gironde ; and Dr. J. B. Noulet from the freshwater beds of Sansan, Gers, although M. Bourguignat denied the accuracy of this identification and described the specimens as *Helix pleuradra*.

PLEISTOCENE.—In South Devon, it is listed by Mr. Pengelly as found in the Happaway Cavern near Torquay.

In South Wilts., it has been recorded from the loess of Fisherton Anger near Salisbury by Mr. T. Blackmore.

In West Sussex, it was discovered by Mr. J. P. Johnson in the buried fluviatile deposit on the foreshore at West Wittering.

In East Kent, it is recorded from the freshwater marls of Charing and Maidstone by Prof. Morris. In West Kent, it is listed by Mr. W. J. Lewis Abbott as found in the Ightham fissure near Wrotham.

In South Essex, Mr. Searles V. Wood has recorded it from the freshwater marls at Grays ; Mr. J. P. Johnson from the Uphall brick-yard, Ilford ; Mr. Blanford from the site of the Victoria Docks ; and Mr. B. B. Woodward from the marl deposit exposed at Walthamstow by the excavations for reservoirs. In North Essex, it is recorded by Prof. Morris from the freshwater marls of Clacton and Harwich ; and by Mr. J. Brown from the black peaty deposit in the brick-field at Copford.

In Middlesex, it is given by Mr. B. B. Woodward from the fluviatile deposits at Clapton ; and was found by Mr. Meyer on the site of the Charing Cross railway station, Blackfriars.

In Cambridge, Mrs. McKenny Hughes enumerates it among the species found in the gravels at Grantchester and Barnwell Abbey.

In Germany, it is recorded by Sandberger as very rare in the Lower Pleistocene sands of Mosbach, Baden ; in the Lower and Middle Pleistocene calcareous tufa of Cannstadt, Thuringia ; and in that of Lower and Upper Pleistocene age at Weimar, Grafentonna, and Burgtonna, Thuringia ; and of Canth in Silesia. Found also in the valley loess of Mid Pleistocene age at Robschutz, Saxony, as well as in the tufa at Mühlhausen, Thuringia.

Dr. Weinland has also put on record its presence in the loess of the Suabian Alps in Wurtemberg ; and Clessin has found it in the tufa at Oberalling near Regensburg, Bavaria.

In France, it is recorded from the Upper Pleistocene of the Somme Valley, and of Bas Boulonnais by M. Locard.

In Italy, it is recorded by Kobelt from the Post Pliocene, Terra Rossa, at Monte Pisano ; by Issel from the Grotto of Verzi in Western Liguria ; and by Pantanelli in Post Pliocene beds at Colle and Chiusdino near Siena in Tuscany.

HOLOCENE.—In West Cornwall, Kennard and Warren record it from blown-sand and associated deposits at Towan Head near Newquay.

In Dorset, it is recorded by Mr. J. C. Mansel-Pleydell from the tufabed at Blashenwell near Corfe Castle; and by Rev. R. Ashington Bullen in the superficial deposits on the Down above Durdle Barn Door and behind Swyre Head.

In the Isle of Wight, it was found by Prof. Forbes in lacustrine beds at Totlands Bay; by Kennard and Warren in the tufa deposit to the south-west of Widdick Chine; and by Bairstow in the sub-aërial beds on St. Catherine's Down.

In South Hants., Mr. J. T. Kemp records it as common in the tufa, Netley Shoal, Southampton Dock; at Mottisfont in the Test Valley; and in the Itchen Valley near the Southampton Waterworks.

In East Kent, Rev. R. A. Bullen has recorded it from the deposit overlying the Rubble drift at Barton Court, Buckland, Dover; and Mr. A. Santer Kennard from the base of a rainwash of Roman age at Darenth, West Kent.

In Surrey, it was found abundantly at a depth of from twelve inches to four feet in a probably early Neolithic deposit at Reigate by the Rev. R. A. Bullen; by Mr. L. E. Adams in the Horseshoe pit; while Mr. Kennard records its presence in the fluvatile carbonaceous silt and underlying sandy loam disclosed by the excavations in Tooley street, Bermondsey; and Mr. T. Belt has found it in alluvial loamy-clay by the Thames bank at Kew.

In South Essex, it is found in deposits at Canning Town, Lea Valley, Tilbury, etc., Witham, Braintree and Raine, Chignal St. James, Roxwell, and Shalford; and in the shell-marl exposed by the excavations for the waterworks at Walthamstow; while the var. *scalaris* was found by Mr. French in the peaty deposit at Hostage's Farm, Felstead.

In Herts., Mr. Hopkinson found it in the old bed of the river Colne, exposed during the excavations for the new gas works at Watford.

In Middlesex, Mr. Loydell has found it in the alluvial marl of the old river-bed, a mile west of Staines on the tow-path to Old Windsor; and Mr. J. E. Cooper in the excavations near the gas-works, Staines.

In Cambridge, it has been found turned up by moles from a probably Romano-British deposit at Harlton by Rev. R. Ashington Bullen.

In East Gloucester, Hinton and Kennard record it from the gravel-pit, Cleeve Hill near Cheltenham.

In Notts., it was found by Mr. C. T. Musson in the black alluvial earth deposits on Bingham Moor.

In Mid-West Yorkshire, Mr. J. W. Jackson has found it in the alluvial deposits of the Ribble at Great Mitton.

In Scotland, it has been found by Mr. T. Scott in a bed of earth and vegetable matter near Elie railway station, Fifeshire.

In Ireland, it was found during 1908 by Mr. Welch in a rainwash in an old dune, Tramore sandhills, Horn Head, Donegal; and Mr. J. G. Milne found it plentifully in the deposits on Achill Islands, West Mayo.

In Germany, Krause has found it in deposits near Bromberg, Posen; and Boettger records a sinistral specimen from the tufaceous limestone near Weissenbrunn in Coburg.

In Denmark, Dr. A. C. Johansen has found it in deposits at Bodilsker in Bornholm; Dyrehavn and Gumperup in Zealand, and in an ancient Neolithic kitchen-midden at Meilgaard, Jutland; while on the authority of

other observers he cites Veistrup Aa and Oxnebjerg in Funen; and for Jutland, Neder Knaberup in Ribe Stift, and Stampeinollen and Skanderborg in Aarhus Stift.

Variation.—This very distinct and handsome species varies somewhat in shape, size, and colouring, but little variation has been observed in the strength and character of the sculpture of the shell, although a var. *infracostata* is cited in Tryon's Manual of Conchology, presumably a modification in which the ridging is more prominent in the basal region.

The rust-red flammular markings which, though occasionally absent, are so distinctive a feature of the species, are especially distinct in young shells, and this, the type form, is regarded as a var. *vulgaris* by Dumont and Mortillet.

Dr. Kobelt gives *H. megerlei* Mabilie and *H. omalisma* Bourguignat as mere varieties of *P. rotundata*, and doubtless there are many other forms figuring under other names which should be relegated to this species.

Specimens inhabiting elevated spots in Savoy, which, owing to some peculiarities of their environment are dwarfed in size and partially denuded of epidermis, have been distinguished as a var. *detrita* by Dumont and Mortillet.

Var. *abietina* Bourguignat.

VARIATION IN FORM OF SHELL

Helix abietina Bourguignat, Mal. Alg., 1864, p. 179, pl. xix., ff. 17-20.

SHELL smaller, with a narrower UMBILICUS; less angulate WHORLS; more compressed and lamellate transverse RIBS; and a proportionately larger last whorl. Diam. 5 mill.; alt. $2\frac{1}{2}$ mill.

This variety is considered by its author as quite intermediate between *P. rotundata* and *P. ruderata*, but can only be really confused with *P. rotundata*, of which it is the representative in Algeria.



FIG. 240.—*Helix abietina* Bourguignat, natural size and enlarged (after Bourguignat).

Italy—S. Croce in Gerusalemme, Rome; Avellano and Maielletta in Abruzzi; Camporotonda in Umbria; and about Aritzo in Sardinia.

Corsica—Recorded by Dr. Scharff from St. Florent.

Algeria—Rare under leaves, stones, etc., at the foot of trees in nearly all the forests of the mountains of Kabylia (Bourguignat, l.c.). According to Lallemant, it has been found in the alluvium of the Harrach, probably derived from the hills of Oued-Djeinma, where it lives under decayed wood.

Var. *turtonii* Fleming.

Helix rotundata Turton's Conch. Dict., 1819, p. 53.

Helix turtonii Fleming, Brit. Anim., 1828, p. 269.

Helix rotundata var. *depressa* Picard, Moll. Somme, 1840, p. 239.

Helix rotundata var. *complanata* Picard, l.c.

SHELL greatly depressed, spire nearly flat.

The sub-var. *depressa* of Picard is described as having a very slightly risen spire, and with the obsolete peripheral keel placed higher than in the type.

The sub-var. *complanata* of Picard is described as quite flat above, with the peripheral angularity placed higher than in the sub-var. *depressa*, and the mouth as transversely depressed.

This is not, however, the *Helix rotundata* var. *depressa* of Férussac (Hist. Nat., pl. 79, f. 5), which is probably the *Helix solaris* of Menke.



FIG. 241.—*P. rotundata turtonii* Fleming, $\times 3$. (Hess Yorks., Mr. J. D. Butterell).

ENGLAND AND WALES.

- Somerset N.—Clevedon, Miss L. C. Jones. Bath (Jeffreys, Br. Conch., 1862).
 Dorset—Portland, Feb. 1890 ! E. R. Sykes. Studland, Aug. 1907, W. E. Brady.
 Isle of Wight—Enumerated by Mr. Loydell.
 Surrey—Croydon, K. McKean. Haslemere, C. Pannell
 Middlesex—Near Hendon, J. E. Cooper.
 Oxford—Wood, Eaton, April 1906 ! H. C. Napier.
 Gloucester W.—Bristol (Jeffreys, Brit. Conch., 1862, p. 219).
 Stafford—Canal bank near Cheadle, April 1891, L. E. Adams.
 Glamorgan—Rare, Cardiff, F. W. Wotton.
 Brecon—Woods near Brecon (Turton's Conch. Dict., 1819, p. 54).
 Radnor—Water-break-its-Neck, 1880 ! C. T. Musson.
 Derby—Hartington, May 1890 ! Lionel E. Adams.
 Lincoln N.—Hubbard's Hill, Louth, 1900, C. S. Carter. South Kelsey, 1902,
 Rev. E. A. Woodruffe Peacock.
 Cheshire—Gatley Wood, J. W. Jackson.
 York S.E.—Hessle, Nov. 1878, J. Darker Butterell. York, S. W. North.
 York N.E.—Scalby Beck-side and Ayton, J. A. Hargreaves.
 York S.W.—Elland, J. Whitwham. Near Calverley, Sept. 1886, J. W. Carter.
 Chapelthorpe, 1885, J. Wilcock. Pontefract, Apr. 1877 ! W. Denison Roebuck.
 York Mid W.—Horton-in-Ribblesdale, Aug. 1878 ! W. Nelson. Abbey Plain,
 Knaresborough, Aug. 1866, J. Blackburn.
 York N.W.—Roadside, Bowes, July 1884 ! W. Denison Roebuck.
 Westmorland and Lake Lancs.—Serpentine Walk, Kendal, J. W. Jackson.
 Isle of Man—Rushen Abbey, Ballasalla ! and Colby Glen, Aug. 1890 ! E. Collier.

SCOTLAND.

- Haddington—North Berwick ! Rev. J. McMurtrie.
 Edinburgh—Salisbury Craigs, Sept. 1888 ! T. Scott.
 Cantire—Machrehanish Bay, Aug. 1888 ! A. Shaw. Near steamboat quay, West
 Loch, Tarbert, June 1886, T. Scott.

IRELAND.

- Antrim—Glenshesk, Sept. 1896, R. Standen.
 Tyrone—Verner's Bridge ! A. W. Stelfox.
 Dublin—Stillorgan, Aug. 1889 ! R. F. Scharff. Bushey Park, R. Welch.
 Galway E.—Clare Galway Abbey, July 1895, R. Standen.
 Cork S.—Bantry Bay (Jeffreys, Brit. Conch., 1862, p. 219).

CONTINENTAL DISTRIBUTION.

France—This form is recorded from the environs of Puy, Haute Loire, and from Arcueil, near Paris, by Pascal ; from the Rhône department by Locard ; from the Cavée de Mérard in the Oise, by Baudon ; from Nîmes in the Gard by Moquin-Tandon ; and as vars. *depressa* and *complanata* from the Somme by Picard.

Switzerland—Brugg, Canton Aargau, May 1885 ! R. Haensler.

Austro-Hungary—Jachno records this as *H. turtoni* from a mossy wall in the Botanical Gardens, Cracow, Galicia.

Italy—Valley of the Serchio, Emilia (Stefani, Bull. Mal. Ital., 1875, p. 42).

Sweden—Westerlund records this variety as frequent about Kalmar.

Var. *scalaris* Férussac.

Helix rotundata monstrum *scalaris* Férussac, Hist. Moll., 1819, pl. 79, f. 5.
Helix rotundata var. *pyramidalis* Jeffreys, Brit. Conch., 1862, p. 219.

SHELL subconical, spire more raised. Diam. $5\frac{7}{8}$ mill. ;
 alt. 4 mill.

The *Helix rotundata* var. *globosa* described by Friedel in 1864 as smaller than the type with an elevated spire, is probably correctly referable to the present variety.

ENGLAND AND WALES.

- Channel Isles—Moulin Huet, Guernsey, and Sark
 (J. R. le B. Tomlin and E. D. Marquand, Journ. of Conch., 1903, p. 287).
 Sussex E.—Ringmer, T. S. Hillman.
 Kent W.—Bickley, T. D. A. Cockerell. Sub-var. *globosa*, Cobham Woods, Nov.
 1908 ! F. H. Sikes.
 Middlesex—Chiswick and near Hendon, J. E. Cooper.
 Surrey—Haslemere (C. Pannell, Journ. of Conch., 1903, p. 9).
 Suffolk E.—Felixstowe, Jan. 1905, F. H. Sikes.
 Gloucester E.—Cooper's Hill, Cheltenham ! W. Nelson.



FIG. 242.—*P. rotundata*
 var. *scalaris* Férussac, $\times 4$
 (Cork, Mr. P. H. Grierson).

- Monmouth**—Wynd Cliff, Chepstow, April 1909 ! F. H. Sikes.
Worcester—Dudley Castle (Tye, Quart. J. of Conch., 1874, p. 69). Sparkbrook near Birmingham ! W. Nelson.
Glamorgan—Swansea and other places (Jeffreys, Brit. Conch., 1862, p. 219).
Pembroke—Under stones, by ditch, Giltar, Tenby (Stubbs, J. of C., 1900, p. 323).
Notts.—Enumerated for the county (B. S. Dodd, Brit. Ass. List, 1893, p. 73).
Lincoln N.—Jericho Plantation, Oxcombe, May 1902 ; a variety with scalarid whorls, alt. 6 mill., at North Reston near Louth, July 1900, C. S. Carter.
Lancashire S.—Near Warrington, Oct. 1885, T. D. A. Cockerell. Farington, Oct. 1888, W. H. Heathcote. Whalley, Aug. 1888 ! E. Collier.
York S.W.—Rare, Elland, J. Whitwham. Stanley Wood, Cubley near Penistone, May 1890, L. E. Adams. Cudworth, March 1903, W. E. Brady. Went Hill near Pontefract, W. and E. Brown.
York Mid W.—Kirkstall Abbey ! and Tadcaster, May 1877 ! H. A. Crowther.
York N.W.—Tanfield, March 1880 !
Westmorland & Lake Lincs.—Cartmel (H. Beeston, J. of Conch., 1908, p. 201).
Isle of Man—Moderately common on the island, L. E. Adams.

SCOTLAND.

- Renfrew**—Shiellhill Glen, 1883 ! T. Scott.
Perth Mid—Quarry Mill den near Perth, H. Coates.

IRELAND.

- Antrim**—Shane's Castle Park, a specimen with height and diameter equal (Thompson, Ann. and Mag. Nat. Hist., Sept. 1840, p. 31). Cushendun, May 1897, Lionel E. Adams.
Dublin—Not uncommon in greenhouse, Bushey Park (Welch and Stelfox, Irish Nat., 1904, p. 124).
Limerick—Roxborough and Ballyclough, H. Fogerty.
Cork S.—Near Macroom, May 1902, P. H. Grierson.
Kerry—Near St. Finian's "holy-well," J. Ray Hardy.

CONTINENTAL DISTRIBUTION.

- Germany**—A high-spined specimen resembling *H. conica* at Schlossberg, Biedenkopf, in Nassau (Kobelt, Nassau List, 1871). Sub-var. *globosa*, Hamburg (Westerlund, Faun. Eur., 1876, p. 37).

France—*H. rotundata* var. *scalaris* Fér. tabulated for Western and Southern France by Grateloup.

Italy—Marchese Paulucci records a variety with greatly elevated spire, and quite solariid in form, in company with type, from the cellars of the Benedictine Convent at Soriano in Calabria.

Sweden—Sub-var. *globosa*, Borgholm in Oeland (Westerlund, Faun. Eur., 1876, p. 37).

VARIATION IN COLOUR OF SHELL.

Var. alba Moquin-Tandon, Hist. Moll., 1855, p. 107.

Helix rotundata var. *a* Férussac, Tabl. Syst., 1822, p. 41.

Zonites radiatus var. *β* Leach, Syn., 1852, p. 74.

Helix rotundata var. *translucens* Dixon and Watson, Man. Brit. Shells, 1858, p. 42.

Patula rotundata var. *albina* Westerlund, Exp. Crit. Moll., 1871, p. 60.

Helix rotundata var. *pallida* Bandon, Journ. de Conch., 1884, p. 231.

SHELL white, often tinged with greenish or yellowish, and quite destitute of the flammular markings so perceptible in the typical form.

This pretty variety is frequently found in colonies, and was formerly considered a very rare form ; the absence of decaying wood about its haunts has been advanced by Herr Clessin as a cause of the variation.

Specimens vary from pure white to those showing a greenish or yellowish tinge, the latter leading to the var. **pallida** of Bandon, which is described as "whitish, with almost imperceptible yellowish markings," and may properly be regarded as a sub-variety, but must not be confounded with dead shells, which under some conditions may be found of a whitish colour with pale brownish blotches.

ENGLAND AND WALES.

- Channel Isles**—One specimen in Sark, July 1886, J. R. le B. Tomlin.
Cornwall W.—St. Mary's, Scilly Isles, Aug. 1903 ! F. H. Sikes.
Cornwall E.—West Looe, April 1909 ! A. H. Jowett-Murray.
Devon S.—Near Plymouth, J. C. Bellamy, 1837. Torcross, Aug. 1885, F. G. Fenn. Topsham and Culverhole, Aug. 1892, Lionel E. Adams.
Devon N.—In marvellous abundance, with hardly any admixture of type, in a small dell on the cliff to the east of Hele Bay, Ilfracombe ! J. R. le B. Tomlin. Local but plentiful at Lynton (F. J. Partridge, Journ. of Conch., 1898, p. 19). Countisbury, Aug. 1892, Lionel E. Adams.

Somerset S.—Dulverton ! Hugh Watson.

Somerset N.—Clevedon ! Rev. A. M. Norman. Minehead, Aug. 1892 ! C. Oldham.

Hants. S.—Christchurch, Charles Ashford.

Sussex E.—Wannock near Eastbourne, Sept. 1881 ! Rev. S. Spencer Pearce. Ranscombe and Landport near Lewes, C. H. Morris. Between the links and Compton road, Eastbourne, 1880, J. H. A. Jenner.

Kent E.—Folkestone, rare, Mrs. J. Fitzgerald.

Kent W.—St. Mary Cray ! Otford ! and Eynsford ! Aug. 1884, T. D. A. Cockerell. Bostal Wood near Woolwich, Sept. 1891, Rev. J. W. Horsley. Greenhithe ! and Orpington ! June 1885 ; and Chislehurst, April 1883, Sydney C. Cockerell.

Surrey—Reigate, G. S. & E. Saunders. Addington, Aug. 1884 ! T. D. A. Cockerell. Croydon, Aug. 1883 ! Richard Rimmer. Bookham ; also very common, Box Hill, Aug. 1883, E. H. Rowe. Betchworth, Nov. 1906 ; and in chalk-pit, Leatherhead, Oct. 1908 ! L. E. Adams. Headley lane, A. Loydell.

Essex N.—“*H. radiata*, I have a beautiful pale-green variety, without rays, from Stour Wood, Ramsey” (Sheppard, Linn. Trans., 1825, p. 162).

Middlesex—Finchley, J. E. Cooper.

Oxford—(Jeffreys, Brit. Conch., 1860, p. 220).

Bucks.—“*H. radiata*, I have some pale specimens of a large size (also without rays) from Dinton Hall grounds in Bucks., a present from Dr. Goodall” (Sheppard, Linn. Trans., 1825, p. 162). Halton Wood, Wendover, Aug. 1908 ! C. Oldham.

Gloucester E.—Cheltenham (W. Webster, Nat., 1854, p. 176). A colony under stones at Whaddon near Gloucester, Nov. 1894 ! A. G. Stubbs.

Gloucester W.—Clifton, Bristol ! T. Rogers. Durdham Downs, Miss E. C. Jellie.

Monmouth—Sub-var. *pallida*, Wynd Cliff, Chepstow, April 1909 ! F. H. Sikes.

Hereford—Bishopswood near Ross, Rev. R. W. J. Smart.

Worcester—Barnt Green, common, July 1885 ! J. G. Madison.

Warwick—Kenilworth Castle (W. Webster, Nat., 1854, p. 176).

Stafford—Great Barr (J. Moore, Midl. Nat., 1885, p. 175). Stone, A. T. Daniel. Dovedale, F. B. Webb. Wren's Nest, Dudley, J. Madison. Ramsor and near Cheadle, Dec. 1889, J. R. B. Masefield.

Salop—(Jeffreys, Brit. Conch., 1862, vol. i., p. 220).

Glamorgan—Old Wales, Cardiff, Oct. 1885 ! F. W. Wotton.

Cardigan—Devil's Bridge, May 1888 ! E. Collier.

Lincoln N.—Brigg ! T. Beaulah. Grisel Bottom, Burwell Wood, July 1900, C. S. Carter. Plentiful, Scawby, June 1895, F. W. Fierke.

Notts.—Debdale near Mansfield, 1881 ! and Cresswell, E. Pickard. Wood, Kirkby-in-Ashfield, Oct. 1885 ! C. T. Musson. Sherwood Rise and Pleasley, B. Sturges Dodd.

Derby—Near Ashbourne, 1889 ! Deepdale and Hartington, 1890, L. E. Adams. Matlock, Jan. 1885, H. E. Craven. Miller's Dale, Aug. 1885 ! C. Oldham.

Cheshire—Wood at Marston, June 1891 (Conch., Sept. 1891, p. 46). Upton near Birkenhead (W. Webster, Nat., 1854, p. 176). Marple, Sept. 1885 ! C. Oldham.

Lancashire Mid—Ashton-on-Ribble, 1886 ! W. H. Heathcote.

York S.E.—Hessle, 1881 ! J. D. Butterell. Howsham Woods, 1889, Tom Petch.

York N.E.—Raincliff Wood, Scarborough, 1894, T. Petch. Wigginton road near York (R. M. Christie, Zool., 1881, p. 247). Hackness, 1896 ; Yedmandale, Forge Valley, and Wrench Green, J. A. Hargreaves.

York S.W.—Ossett road, Wakefield, July 1872 ! J. Wilcock. Elland ! and Golcar, rare, J. Whitwham. Stapleton Park, Went Vale, May 1864 ! W. Nelson. Conisborough Castle, June 1873 ! G. Taylor. Stanley Wood, Cubley, May 1890 ; Campsall, May 1886 ! W. Denison Roebuck. Bramley Fall Wood, 1890, F. Rhodes.

York Mid W.—Castleford, 1876* ! J. Beevers. Tadcaster, 1877 ! H. Crowther. Pool Bank, Otley, Oct. 1886 ! J. A. Hargreaves. Bingley, Apr. 1873, J. Wilcock. Pannal and Whinmoor near Seacroft, May 1876 ! W. Nelson. Fagley Woods (Soppitt and Carter, Nat., 1888, p. 101). Crina Bottom, Ingleton, July 1886 ! H. Shaw. Grassington, Sept. 1900, F. Rhodes.

Durham—Very rare, Tanfield ! (J. Alder, Newcastle List, 1848, p. 131).

Northumberland—Benwell lane ! (J. Alder, Newcastle List, 1848, p. 131).

Isle of Man—Port Erin, Apr. 1880, L. E. Adams. Niarbyl Bay, Aug. 1892 ! W. Moss and R. Cairns. Curragh and Sulby, May 1904, J. R. le B. Tomlin.

SCOTLAND.

Renfrew—Cloch ! and Shielhill Glen, Aug. 1883, T. Scott.

Berwick—Ruins of Dryburgh Abbey, Aug. 1886 ! W. Denison Roebuck.

Haddington—Bass Rock, as common as the type, Oct. 1888, Rev. J. McMurtrie.

Edinburgh—Arthur's Seat, Edinburgh, Apr. 1883 ! R. F. Scharff. Cramond Island, Sept. 1888 ! T. Scott. Braid road, Lothianburn, Apr. 1890 ! W. Evans.
Perth Mid—Kinnoul Hill, F. Buchanan White.
Perth N.—Pitlochry, H. Coates. Barnhill, J. Dawson.
Aberdeen S.—F. Buchanan White, Scot. Nat., vol. ii.
Westerness—Pictish Tower, Glenelg, July 1889 ! Alex. Somerville.
Main Argyle—Ruins, Dunstaffnage Castle, Oban, Aug. 1902 ! E. Collier.
Dumbarton—Crosslet near Dumbarton, Aug. 1886 ! W. Denison Roebuck. Canal bank near Garscadden, June 1889 ! A. Shaw.
Canterbury—Near steamboat pier, West Loch Tarbert, June 1886 ! T. Scott.
Ross W.—Balmacarra, Sept. 1906 ! Rev. R. Godfrey.
Orkneys—South Ronaldshay, Aug. 1905 ! Rev. R. Godfrey.

IRELAND.

Derry—Rejactamenta of the river Bann, Coleraine, April 1884 ! L. E. Adams.
Antrim—A numerous colony in damp hollow at foot of cliff talus, Portnoffer Bay, Giant's Causeway, 1893, J. R. le B. Tomlin.
Down—Holywood House (W. Thompson, Ann. and Mag. Hist., 1840, p. 31).
Dublin—Killiney (W. W. Walpole, Zool., 1853).
Tipperary S.—Glenconner, Sept. 1888 ! Rev. A. H. Delap.
Cork S.—Roche's Hotel grounds, Glengariff, Aug. 1899 ! E. Collier.

CONTINENTAL DISTRIBUTION.

Germany—Recorded from Alsace by Meyer; tolerably common in Nassau Kobelt's Nassau List, 1871). Geographal in Thuringia, May 1904 ! F. H. Sikes. Among loose stones in the Mussel-limestone region near Ochsenfurt in Bavaria (Clessin, Mal. Bl., ii., p. 156).

Belgium—Common at Ollignies near Lessines in Hainault (T. Le Comte, Bull. Soc. Mal. Belg., 1871, p. 51). In Brabant, it is common at Hastière; also found at Villers and near the dyehouse, Ronze-Clôître (Van den Broeck, op. cit., 1869, p. 96). Verviers (Colbeau, op. cit., p. 85). Tervueren (Raeymaekers, op. cit., 1887, p. 68); and among ruins of the Abbey of Aulne, April 1871 (Roffiaen, op. cit., 1871, p. 15). In Luxemburg, it is found at Roumont (Purves, op. cit., 1870, p. 49).

France—The truly typical specimens are said by Locard to be found at Grande-Chartreuse, Isère. It is recorded from Remiremont, Vosges, by Puton; from Grasse, Alpes Maritimes, by Astier; from Calvados by de l'Hôpital; from the summit of Teix near St. Saulge, Nièvre, by Brevière; from Chavornay in Ain and Lyons in the Rhône, by Locard; Forest of Hez in the Oise, by Baudon; Mont Dore, Puy-de-Dôme, by P. Fischer; from Arcueil, Seine, and the wood of Mendon, Seine-et-Oise, by Pascal; the Gorge of Dissaz, and at Servoz in the Chamouni valley, Haute Savoie by Roffiaen. The sub-var. *pallida* is recorded from Mondragon forest, Côte d'Or by Watted; and from the wood at Angy, Oise, by Baudon.

Switzerland—Wood at St. Gervais near Geneva (A. Brot).

Sicily—Madonie and about Palermo (Benoit, Sicilian List, 1882, p. 57).

Norway—Var. *albina*, Malmøen, Christiania (Esmark, J. of Conch., 1886, p. 104).

Sweden—Recorded from the Island of Oeland by Westerlund.

Var. **grisea** Moquin-Tandon, Hist. Moll., 1855, ii., p. 107.

SHELL dark grey, without markings.

Herts.—On rockery in garden, Watford, July 1883 ! John Hopkinson.

France—Rare, Auch, Gers (Dupuy). Pyrénées and at Grasse, Alpes Maritimes (Moquin-Tandon). Caen, Calvados (de l'Hôpital); and the Rhône (Locard).

Belgium—Roumont, Luxemburg (Van den Broeck).

Switzerland—Chillon, Canton Vaud, Aug. 1879 (F. Roffiaen).

Var. **olivacea** Moquin-Tandon, Hist. Moll., 1855, ii., p. 107.

Helix rotundata var. *d.* Porro, Mal. Comasca, 1838, p. 46.

SHELL olivaceous, without markings.

Germany—Uniformly olive-green shells are not rare at Eisenach, Thuring' (Boettger, Nach. Deutsch. Mal. Ges., 1878, p. 2).

France—Environs of Rodez, Aveyron (Moquin-Tandon, l.c.). Department of the Yonne (Comm. Caziot).

Italy—Como, Lombardy (Porro, l.c.)

Var. rufula Moquin-Tandon, Hist. Moll., 1855, ii., p. 107.

Helix rotundata var. *δ* Draparnaud, Tabl., 1801, p. 93.

Helix rotundata var. *β unicolor* Gassies, Moll. Agen, 1849, p. 106.

Helix rotundata var. *obscurata* Dumont and Mortillet, Moll. Sav., 1857, p. 42.

Helix rotundata var. *subrufula* Pascal.

SHELL of a brown or fawn colour, without or with scarcely visible markings.

The var. **rufula** s.s. is of a fawn colour, without markings.

The sub-var. **obscurata** is brown, with few and faint fawn fleckings.

The sub-var. **subrufula** is dark fuscous, with scarcely perceptible flammules.

This variety is the one most likely to be confused with *P. rudrata*; and it is hoped that a careful study of specimens in the field and in collections will result in the addition of *P. rudrata* to our fauna.

Middlesex—Harefield, J. E. Cooper.

Herts.—On rockery in garden, Watford, July 1883! and in Swiss Cottage woods, Cassiobury Park, John Hopkinson.

Northampton—Maidwell, March 1905, Rev. W. A. Shaw.

Lincoln N.—Burton road, Lincoln, April 1907! J. F. Musham.

Notts.—In cellars, Nottingham, April 1884! C. T. Musson.

Germany—An unicolorous brown variety, found by Dr. Koch, in Feldebacher Waldchen, in Nassau.

France—The sub-var. *subrufula* implied to exist in the Haute Loire and the environs of Paris by Pascal, the describer; the sub-var. *unicolor* is enumerated by Gassies for the Agenais; the var. *rufula* is recorded from Montpellier, Ganges, etc., in Hérault, by Moquin-Tandon and Dubrueil; and by Mauduyt from Vienne; and the sub-var. *obscurata* is quoted from Savoy by Dumont and Mortillet.

VARIATION IN SIZE OF SHELL.

Var. major Locard, Etud. Var. Moll., 1880, vol. i., p. 73.

SHELL larger, usually somewhat depressed, and paler than the type. Diam. 8.9 mill.

Notts.—In a damp scullery, Highfield House, Beeston near Nottingham (E. J. Lowe, Conch. Notts., 1853).

France—Hills of Bon, near Belley, Ain (Locard, Moll. Ain, 1881, p. 32).

Belgium—Chaufontaine in Liège (Piré, Bull. Soc. Mal. Belg., 1872, p. 8). Of very large size at Rochefort in Namur (Van den Broeck, op. cit., 1870, p. 46).

Var. minor Jeffreys, Brit. Conch., 1862, p. 219.

SHELL smaller. Diam. 5 mill.; alt. 2 mill.

According to Jeffreys, this is probably an alpine form. He remarks that he has observed it not only in the Jura and the Alps, but also in the Shetland Isles and Guernsey, and considers its presence in our Upper Tertiaries as an evidence of its northern origin.

Channel Isles—Guernsey (Jeffreys, l.c.).

York S.W.—Elland, rare, 1884, J. Whitwham. Old quarry, Bottoms, Heckmondwike, June 1902! and among ruins of Clough Mill, Liversedge, March 1901! Thomas Castle.

Ayr—Near Skelmorlie, July 1889! A. Shaw.

Clyde Isles—Near aquarium, Rothesay, Bute, Nov. 1886! T. Scott.

Shetland Isles—(Jeffreys, l.c.).

Down—Aghaderg Glebe, Loughbrickland, Aug. 1888! C. H. T. Lett.

Switzerland—The Jura and the Alps (Jeffreys, l.c.).

MONSTROSITIES.

Monst. sinistrorsum Boettger, Nachbl. Deutsch. Mal. Ges., 1879, p. 2.

SHELL reversed in coiling.

Middlesex—In garden, Burlington lane, Chiswick, Oct. 1895! A. Sich.

Bucks.—Among dead leaves, Burnham Beeches, July 1908, J. E. Cooper.

Derby—Castleton, May 1902, J. W. Jackson.

Down—Aghaderg Glebe, Loughbrickland, Aug. 1888! C. H. T. Lett.

Thuringia—A fossil specimen found by Dr. Loretz in tufaceous limestone near Weissenbrunn, Coburg (O. Boettger, l.c.).

Monst. **scalariforme** Taylor.

SHELL with the spire irregularly produced and the whorls more or less completely dislocated.

This form, which may be considered to include the less striking deviations indicated by Dr. Baudouin's *subscalare*, is somewhat uncommon.

Kent W.—Sub-var. *subscalare*, Maidstone, H. Leslie.

Glamorgan—Sub-var. *subscalare*, near Cardiff, March 1888, F. W. Wotton.

Lancashire S.—A very fine corkscrew specimen found by Mr. F. C. Long at Whalley, July 1887 !

Galway E.—Sub-var. *subscalare*, Clonbrock, June 1896 ! R. F. Scharff.

Geographical Distribution.—*Pyramidula rotundata* is very generally dispersed throughout the British Isles, though often less plentiful near the coast, and I have seen and verified examples from practically every district into which the kingdom has been divided.

On the continent, its area of distribution is also very compact and continuous, and shows this species to be a dominant one in its group. It does not, however, appear to range further north than about 63° north lat., and to the east is only known from Poland and the Crimea in Russia, although it has been reported, probably in error, by Dr. Boog Watson and M. Locard as inhabiting Finland.



FIG. 243.—Geographical Distribution of *Pyramidula rotundata*.

It is apparently diffused throughout France, Germany, Netherlands, Switzerland, Austro-Hungary, Denmark, Italy, the Iberian peninsula, and exists in Madeira and the Azorean islands. In Scandinavia it is restricted to the southern parts, and has been reported from Algeria as *H. abietina*.

GERMANY.

Probably found in every kingdom and principality, and actually recorded for Alsace, Anhalt, Baden, Upper and Lower Bavaria, Brandenburg, Coburg, Darmstadt, Upper and Lower Franconia, Hanover, Holstein, Lippe, Lorraine, Luneburg, Magdeburg, Merseburg, Nassau, Oldenburg, Pomerania, Posén, East and West Prussia, Pymont, North and South Rhineland, Saxony, Silesia, Suabia, Thuringia, North Westphalia, and Wurtemberg.

Distribution of *Pyramidula rotundata* (Müll.)

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles		SOUTH WALES
PENINSULA	41	Glamorgan
1 Cornwall W.	42	Brecon
2 Cornwall E.	43	Radnor
3 Devon S.	44	Carmarthen
4 Devon N.	45	Pembroke
5 Somerset S.	46	Cardigan
6 Somerset N.		NORTH WALES
CHANNEL	47	Montgomery
7 Wilts N.	48	Merioneth
8 Wilts S.	49	Carnarvon
9 Dorset	50	Denbigh
10 Isle of Wight	51	Flint
11 Hants S.	52	Anglesey
12 Hants N.		TRENT
13 Sussex W.	53	Lincoln S.
14 Sussex E.	54	Lincoln N.
THAMES	55	Leic. & Rutld.
15 Kent E.	56	Notts.
16 Kent W.	57	Derby
17 Surrey		MERSEY
18 Essex S.	58	Cheshire
19 Essex N.	59	Lancashire S.
20 Herts.	60	Lancashire Mid
21 Middlesex		HUMBER
22 Herts.	61	S.E. York
23 Oxford	62	N.E. York
24 Bucks.	63	S.W. York
ANGLIA	64	Mid W. York
25 Suffolk E.	65	N.W. York
26 Suffolk W.		TYNE
27 Norfolk E.	66	Durham
28 Norfolk W.	67	Northumb. S.
29 Cambridge	68	Cheviotland
30 Bedford		LAKES
31 Hunts.	69	Westmorland
32 Northampton		and L. Lanes
SEVERN	70	Cumberland
33 Gloucester E.	71	Isle of Man
34 Gloucester W.		
35 Monmouth		
36 Hereford		
37 Worcester		
38 Warwick		
39 Stafford		
40 Salop		

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easternness
76 Kenfrew	W. HIGHLANDS
77 Lanark	97 Westernness
E. LOWLANDS	98 Main Argyle
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Fth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

NETHERLANDS.

Belgium—Quoted by M. Jules Colbeau and others from the provinces of Antwerp, Brabant, East and West Flanders, Hainault, Liège, Limburg, Luxemburg, Namur, and the Grand Duchy of Luxemburg.

Holland—Reported by Heer Schepmann for Gelderland, Groningen, North and South Holland, Limburg, Utrecht, and Zeeland.

FRANCE.

Distributed throughout the country and has been recorded from Ain, Aisne, Agenais, Allier, Alpes Maritimes, Aquitaine, Ardennes, Ariège, Aube, Aude, Auvergne, Aveyron, Basses Alpes, Basses Pyrénées, Calvados, Charente Inférieure, Côte d'Or, Côtes du Nord, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Hautes Pyrénées, Haute Savoie, Hérault, Ile-et-Vilaine, Isère, Jura, Landes, Loire Inférieure, Lot, Lot-et-Garonne, Lozère, Maine-et-Loire, Manche, Meuse, Morbihan, Moselle, Nièvre, Nord, Oise, Pas-de-Calais, Puy-de-Dôme, Pyrénées Orientales, Rhône, Saône-et-Loire, Sarthe, Savoy, Seine, Seine Inférieure, Seine-et-Marne, Seine-et-Oise, Somme, Var, Vaucluse, Vendée, Vienne, Vosges, Yonne, and the Island of Corsica.

ITALY.

P. rotundata is diffused throughout the peninsula and islands, being recorded for Liguria, Piedmont, Lombardy, Venetia, Emilia, Tuscany, Umbria, Marches, Abruzzi, Romana, Calabria, Campania, and the Islands of Sardinia and Sicily.

AUSTRO-HUNGARY.

Commonly diffused throughout the empire, records being known of its existence in Austria, Bohemia, Carniola, Carinthia, Galicia, Goritz, Hungary, Moravia, Transylvania, and the Tyrol.

SPAIN AND PORTUGAL.

Spain—Found in Aragon, Catalonia, Galicia, Murcia, Navarre, Santander and Soria in Old Castile, Pena de Orduna in the Basque provinces, Cordoba in Andalusia, and the Balearic Isles.

Portugal—Enumerated by Morelet for Oporto in Minho.

SWITZERLAND.

Well distributed over the country, and has been recorded for the cantons of Aargau, Appenzell, Berne, Geneva, Glarus, Grisons, Lucerne, Neuchâtel, St. Gall, Schwyz, Ticino, Uri, Valais, Vaud, and Zurich.

SCANDINAVIA.

Norway—Apparently restricted to the more southern districts. It is recorded by Sars from Bergen; from the Islands of Sarterö and Manger by Dr. von Martens; by Esmark from Laurvik near Christiania, and Brevik, Langesund, and Skien in Christiansand Stift; while in South Trondhjem Mr. Stelfox found it, though rarely, in June 1863, at Romsdal; and Dr. von Martens records it for the Island of Aalesund.

Sweden—Common in the southern provinces, and extending as far north as Stockholm. Westerlund cites the species as found in Skane, Blekinge, Kalmar, Jönköping, Westergötland, Ostergötland, Gothenburg, and the Islands of Oeland and Gothland.

Denmark—One of the commonest of Danish species, probably occurring in every part, but according to Dr. Johansen has not yet been recorded from Ribe Stift in East Jutland.

RUSSIA.

Not recorded except from Poland and the Crimea. Dr. Boog Watson records its distribution as from Finland to Madeira; but Luther in his exhaustive work on the shells of Finland does not include this species.

NORTH AFRICA AND ATLANTIC ISLES.

Algeria—Var. *abietina* recorded from Kabylia and the alluvium of the Harrach.

Azores—St. Michael and Horta, Fayal Islands.

Madeira—Probably introduced, but common in a garden above Funchal at an altitude of 2,000 feet; and a single specimen in the Rebeiro dos Socorridos (R. Boog Watson, Journ. de Conch., 1876, p. 222).

FOSSIL SPECIES.

GENUS *PYRAMIDULA* Fitzinger.SUB-GENUS *Charopa* Albers.**Pyramidula omphala** (Edwards).*Helix striatella* S. V. Wood, Geol. Journ., i., p. 118 (not Anthony).— *omphalus* Edwards, Mon. Eoc. Moll., 1852, p. 65, pl. 10, ff. 6 a-e.*Patula omphalus* Sandberger, Vorwelt, 1872, p. 289, pl.

SHELL somewhat discoidal, with a slightly exerted SPIRE of about four (or according to the figure, between five and six) rounded or bluntly convex WHORLS, but which in two casts of fully-grown individuals in Mr. Edwards' collection presented a subcarinate periphery; and shallow rounded sulci in the lines of growth, which are oblique, undulating, and rounded; the margins of the depressed semilunar APERTURE are simple and unreflected; and the UMBILICUS perspectively open. Diam. 7 mill.; alt. 3 mill.



FIG. 244.



FIG. 245.

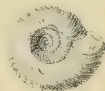


FIG. 246.

Pyramidula omphala (Edwards).

FIG. 244.—Natural size.

FIG. 245.—Upper, frontal, and basal aspect, $\times 2$.FIG. 246.—Sculpture of body-whorl, $\times 5$ (after Edwards).

Mr. Searles V. Wood formerly regarded this species as identical with the *Pyramidula striatella* of Mr. J. G. Anthony, but our species has a less elevated spire, deeper sulci, and other points of difference.

Prof. Sandberger considers this species to have its closest affinity to *Pyramidula comma* of Gray, a native of New Zealand, and a member of the sub-genus *Charopa*, an ancient group almost peculiar to the islands of the South Pacific Ocean.

If this allocation be correct, *P. omphala* may be considered as especially representative in this country of the fauna characterizing New Zealand at the present day, and our most primitive form of the genus.

Charopa, however, differs from *Discus* chiefly in the tendency of the upper lip to recede at its junction with the penultimate whorl and form



FIG. 247.

Pyramidula omphala (Edwards MS.), $\times 4$.

After photograph of Edwards' type shell in the British Museum.

an incipient sinus; but this feature, though distinctly shown in Edwards' original figure (fig. 246) of the whorl-sculpture of *P. omphala*, is not confirmed by the illustration here given (fig. 247), which is from an enlarged photograph of the type specimen in the British Museum, and does not appreciably differ from the species of the sub-genus *Discus* in the character of its form and sculpture.

BRITISH ISLES.

Oligocene—In the Isle of Wight, it is recorded by Dr. Sandberger from the Bembridge limestone at Sconce; by Mr. Charles Ashford from the Osborne series, and from Bembridge, Hempstead, Whitecliff Bay, etc., in the Bembridge series.

In South Hants., it has been found by Mr. Searles Wood in the freshwater bed at Hordwell Cliff.

SUB-GENUS *Janulus* Lowe.**Pyramidula suttonensis** (S. V. Wood).*Helix suttonensis* S. V. Wood, Monog. Crag. Moll., 1872, p. 2, pl. 1, ff. 2 a-c.

SHELL depressly orbicular, composed of about seven slowly increasing and almost subangulate WHORLS, and a moderately exerted SPIRE; the apical whorl is smooth, but the upper surface of the rest of the shell is beautifully costulate by thick, round, and transverse ridges at regular intervals, of which there are about eighty on the outer volution; SUTURE very deep and distinct, the edges of the whorls being slightly elevated at their junction with the preceding volution. The under surface is very convex and quite smooth, and the UMBILICUS small but funnel-shaped and deep. APERTURE narrowly lunate and slightly reflected.

Diam. about 6 mill.; alt. $3\frac{1}{2}$ mill.

FIG. 218.—*Helix suttonensis* (S. V. Wood) enlarged (after Wood).

P. suttonensis is apparently most nearly related to *P. bifrons*, to which it bears a close resemblance, differing, however, in its more risen spire, more numerous whorls, and in the number and size of the costulate ridges.

The affinities of the present and the succeeding species are with the primitive molluscan fauna now inhabiting the Island of Madeira.

BRITISH ISLES.

Pliocene—Mr. Wood discovered this unique specimen (now in the British Museum) in 1867 in the truly marine formation, the coralline crag at Sutton, East Suffolk.

Pyramidula rysa (S. V. Wood).*Helix rysa* S. V. Wood, Mon. Crag Moll., 1848, p. 4, pl. f. 1.*Helix rufescens* var. ? J. G. Jeffreys, Quart. Journ. Geol. Soc., 1871, p. 493.

SHELL depressly orbicular, about equally convex above and below, the upper surface rugosely striated or rather corrugated and faintly striate below; WHORLS seven, obtusely but distinctly keeled at the periphery, the keel being visible at the SUTURE on the upper whorls; APERTURE broadly lunate, with a sharp and reflected peristome; UMBILICUS distinctly, but not widely open.

Diam. 16 mill.; alt. 6 mill.

FIG. 249.—*Helix rysa* (S. V. Wood) enlarged (after Wood).

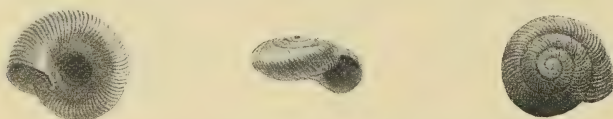
P. rysa also has its affinities and relationship with the peculiar species now restricted to the Atlantic Isles, although Dr. Jeffreys was inclined at one time to regard this species as a variety of *H. rufescens*; but the present shell is larger, has seven volutions, is more distinctly corrugated above, and the keel is visible to the apex.

BRITISH ISLES.

Mid-Pliocene—The type specimen of this species was, according to Mr. Wood, found by Mr. G. S. Gibson, of Saffron Walden, within the aperture of a *Buccinum undatum*, in the Red Crag of Walton-on-the-Naze, North Essex, and is now deposited in the Saffron Walden Museum. A second specimen has since been obtained by Mr. Canham from the Coprolite diggers at Waldringfield, East Suffolk.

SUB-GENUS *Discus* Fitzinger.**Pyramidula ruderata** (Studer).*Helix ruderata* Studer, Kurz. Verz., 1820, p. 86.— *rotundata* β Nilsson, Moll. Suec., 1822, p. 31.— *umbilicus* Marklin, ex. L. Pfeiffer, Symb., 1842, vol. ii., p. 106.— *flocculus* Morelet, Journ. de Conch., 1858, vol. vii., p. 8.— *pauper* Gould, Proc. Boston Soc. N.H., 1859, vol. vi., p. 423.— *crankhitei* Newcomb, Proc. Cal. Acad. Sci., 1865, vol. iii., p. 180.*Discus ruderatus* Fitz., Syst. Verz., 1833, p. 9.*Patula ruderata* Held, Isis, 1837, p. 916.*Euryomphala ruderata* Beck, Ind. Moll., 1837, p. 9.*Patularia ruderata* Clessin, Natur. Ver. Regensburg, 1908, p. 11.***Pyramidula ruderata*** Pilsbry, Manual of Conchology, 1893, pt. 33, p. 46.

SHELL depressed, but more convex above than below, with a slightly risen SPIRE and blunt apex; WHORLS four to five, rounded at the periphery; of a uniform brownish or yellowish-horn colour, and finely but distinctly ridged transversely. APERTURE slightly oblique and roundly lunate with an acute peristome. UMBILICUS widely and perspective open. Diam. 5.6 mill.; alt. 2½-3 mill.

FIG. 250.—*Pyramidula ruderata* (Studer) $\times 3$, showing basal, frontal, and upper aspects (Finland).

Diagnosis.—*P. ruderata* differs from its close ally *P. rotundata* by its more produced spire, fewer and more rounded whorls, and the absence of the red-brown freckles so conspicuous in that species, although according to Dr. W. H. Dall, the *Helix flocculus* of Morelet, a form of *P. ruderata*, is characterized by red-brown or deep-red radiating maculations upon the mantle, showing through the translucent shell; but according to Mr. Binney this appearance is partially due to fugitive colouring of the shell substance, a feature of interest as showing its relationship with *P. rotundata*.

Variation.—A white variety, *albina*, is recorded by Miss Esmark as found in Norway at Tin in Telemarken, Røvenæs in Porsangerfiord, and Elvenæs in South Varanger (Journ. of Conch., 1886, p. 104); the var. *albida* is cited from Christiania by Dr. Westerlund, and Mäntsälä, Koli, and Pielisjärvi in South Finland by Luther, while the "clear hyaline variety" is, according to Rev. S. Spencer Pearce, frequent in the Upper Engadine, Switzerland. The var. *viridis* is recorded by Dr. Oscar Boettger as found rarely with the type at Kusary in government of Baku, Transcaucasia; and the var. *viridula* is noted by Prof. Cockerell from Custer co., Colorado.

The var. *angulosa* Mousson is recorded for Tomsk, Irkutsk, Kamtschatka and the valley of the Amur; the var. *opulens* of Westerlund from Kamtschatka, and a var. *gorktschana* has been described by Prof. Mousson from Erivan, Transcaucasia.

Geographical Distribution.—This circumpolar species, which would seem to be a weaker forerunner of *P. rotundata*, is very widely dispersed over the northern regions of the Holarctic realm, extending to the furthest limits northwards, and ascending the mountain slopes to as great a height as molluscan life can exist, yet the species is only known in this country by its fossil remains, though it is by no means unlikely that isolated colonies may still linger within the limits of the British Isles.

In a living state, it is in Western Europe chiefly restricted to the mountainous regions, being found throughout the Alps, the Jura, the Harz Mountains, the Erzegebirge, the Carpathians, and other mountainous chains; but in Eastern Europe, where the competition of the more advanced forms is less severe, it descends to and lives on the plains.

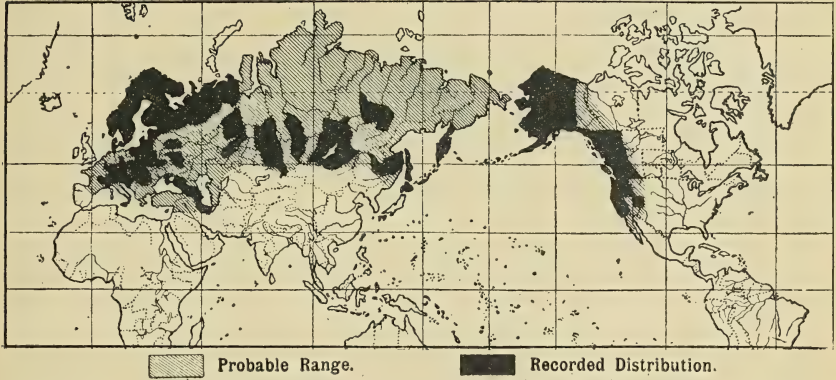


FIG. 251.—Geographical Distribution of *Pyramidula ruderata* (Studer.)

In Germany, it occurs in Anhalt, Bavaria, Brandenburg, Baden, Cassel, Lippe, Nassau, Prussia, Saxony, Silesia, Thuringia, and Wurtemberg.

In France, it is found in Ain, Côte d'Or, Hautes Alpes, Jura, Savoy, and, according to Jordan, in the sub-alpine regions of the Pyrenees.

In Switzerland, it has been found in the Cantons Berne, Glarus, Grisons, Ticino, and Vaud, while it has been collected by Mr. E. Collier at an altitude of 7,000 feet at Corbeyrier in the Valais.

In Italy, it is known from Lombardy and from many localities in Piedmont up to an altitude of 9,000 to 10,000 feet on the Col d'Ollon, and has been reported by Porro from Sicily.

In Austro-Hungary, it is found in Banat, Bohemia, Carinthia, Carniola, Galicia, Hungary, Moravia, Salzburg, Styria, Transylvania, and Tyrol.

In Scandinavia, it is found throughout the peninsula to its most extreme northern limits, and is especially plentiful beyond 59° north lat. in Norway, Sweden, and Lapland. In Denmark, it is found in Jutland, and also on Zealand and Bornholm.

In Russia, it is found in many parts, extending over the Kola Peninsula and to the shores of the Arctic Ocean, and has been specially noted as existing in Archangel, Courland, Crimea, Finland, Kharkov, Livonia, Moscow, Olonetz, Orel, Orenberg, Perm, Poland, Smolensk, St. Petersburg, Voronesh, Volhynia, as well as in Kuban, Ciscaucasia, and Suanetien, Colchis, Tiflis, Erivan, Baku, etc., Transcaucasia.

In Asia, it is found in Armenia and in North-West Persia, throughout Siberia, extending to North China, Kamtschatka, and the Islands of Japan; and is tabulated as inhabiting the valleys of the Yenissei, the Lena, and the Amur; as var. *pauper* Gould it is recorded from the Behring and Commander Isles, and Petropavlovsk, Kamtschatka, by Dall.

In the Nearctic region, it is recorded as the var. *pauper* of Gould from Alaska, as the var. *cronkhitei* it is diffused along the Pacific States, being recorded from Alaska, British Columbia, Oregon, Nevada, and California, and by Prof. Cockerell from Colorado; and as var. *gorktschana* of Mousson from Ouray co., Colorado, by Mr. W. G. Binney.

Geological Distribution.—In the fossil state, this species has apparently not yet been found below the Post-Pliocene strata; it may, however, be expected to be eventually discovered in more ancient deposits.

Pleistocene—It appears to be dispersed over the gravel and brick-earth deposits of the south-east of England.

In West Sussex, Mr. J. P. Johnson discovered it in the old river-bed on the foreshore at West Wittering.

In West Kent, it is enumerated by Kennard and Woodward from the Ightham fissure near Wrotham; and from the fluvatile gravel deposit at Swanscomb.

In North Essex, it is said to be not uncommon at Clacton, and is also known from Copford; while in South Essex it has been found at Ilford.

In Cambridge, Rev. E. S. Dewick found a single shell in the Barnwell gravels.

In Germany, it is rare in Upper and Lower Pleistocene tufa at Weimar, Thuringia, and in the Lower Pleistocene sands of Mosbach, Baden.

In Austro-Hungary, it is not rare in Lower and Middle Pleistocene valley loess at Nussdorf near Vienna.

In Switzerland, Mousson found it rarely in Mid Pleistocene loess of St. Gall.

Holocene—In Belgium, where it is now believed to be extinct, its remains have been found in the "Tourbe" at Uccle lez-Bruxelles by Grégoire.

In Bavaria, Herr Clessin records one specimen from the tufa at Oberalling near Regensburg; and cites it from the tufa beds by the Ammersee, Upper Bavaria.

In Austria, Herr Clessin records it from the loess at Heiligenstadt near Vienna.

In Sweden, Dr. Westerlund found it in a submarine peat-bed at Ystad in Skane.

In Denmark, Dr. Westerlund records it as found in calcareous tufa; and Dr. Johansen cites it from the freshwater limestone at Bodilsker in Bornholm, and from the marl-bed at Gytje in Jutland.

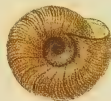


FIG. 252.—Ightham fissures, in the Valley of the Shole, near Wrotham, West Kent, as they appeared on the visit of the Tonbridge Field Club in 1895. The main fissure from whence most of the fossils have been obtained is on the left (reproduced by permission of Mr. W. J. Lewis Abbott).

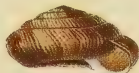
PUNCTUM, PYRAMIDULA, HELICIGONA.



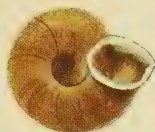
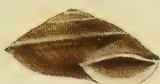
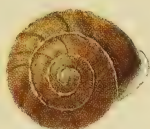
Punctum pygmaeum (Drap.) $\times 10$.
Shipley Glen, Yorks., F. Booth (from photo. by W. Bagshaw).



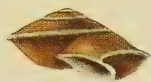
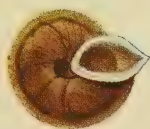
Pyramidula rupestris (Drap.) $\times 5$.
Grassington, Yorks., F. Booth (from photo. by W. Bagshaw).



Pyramidula rotundata (Müll.) $\times 3$.
Roundhay, Leeds (from photo. by W. Bagshaw).



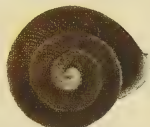
Helicigona lapicida L.
Cooper's Hill, near Cheltenham.



H. lapicida v. *infrafasciata* Taylor.
Wells, Rev. S. S. Pearce.

H. lapicida L.
Went Vale, Yorks.

H. lapicida v. *bifasciata* Taylor.
Wells, Rev. S. S. Pearce.



H. lapicida v. *albina* Menke.
Grantham, T. Stow.

H. lapicida v. *radiata-grisea* Moq.
Pyrenées Orientales, E. Collier.

H. lapicida v. *nigrescens* Taylor.
Starbottan, Yorks., W. D. Roebuck.

FAMILY HELICIDÆ Linné.



Henry A. Pilsbry

THE very extensive and important family *Helicidæ* is associated with Dr. H. A. Pilsbry, the conservator of the Academy of Natural Sciences, Philadelphia, U.S.A., and author of that marvellous monument of learning and industry, "The Manual of Conchology," who is universally recognized as one of the most profound malacologists of our time, and as a result of many years study of the phylogeny, organization, affinities and distribution of the *Helicidæ*, has propounded the most satisfactory and philosophical classification of the family that has yet appeared, an arrangement which throws a flood of light upon their phylogeny and routes of dispersal from the theatre of their evolution.

The family is characterized by possessing a more or less globose shell with an expanded or reflected lip; the animal has the foot-margins without the well-defined pedal

grooves so distinctly developed in the *Zonitidæ*, etc.; and the marginal teeth possess quadrate basal plates bearing one or more cusps or cutting-points, but the outer one is never elevated on the mesocone or middle cusp.

The group is divided by Dr. Pilsbry into five great divisions, which are distinguished as *Protogona*, *Macrogonæ*, *Teleophallogona*, *Epiphallogona*, and *Belogona*.

The PROTOGONA are an excessively ancient group, and are believed to stand nearest the ancestral stock on account of the simplicity of their organization and the remote regions they now occupy, to which they have been driven by the competition of more modern groups.

They probably originated on European soil, from whence they gradually diffused themselves over the globe, but have long since been expelled from the Palearctic regions by the improved forms which were gradually evolved within the most active evolutionary area, so that they are now dominant only in remote regions, separated by the sea or other almost insuperable barriers from contact and invasion of the more highly advanced forms, their chief sanctuaries being the southern extremities of the American, African, and Australian continents, and the more remote islands of the Malayan Archipelago. In the eastern United States, the *Protogona* are still dominant, being shielded by the lofty mountain ranges from the invasion of the more highly organized Belogonous species inhabiting the Pacific slope, but their rear is in many cases closely pressed and overlapped by their Epiphallogonous successors.

Though no Protogonous species now exist in this country, nor their fossilized remains been recognized in British deposits, yet at some far remote period they were probably the dominant *Helicidæ* of the world, and have been practically universal in distribution; but their geographical range has been gradually encroached upon by later developed, superior species, and the area they inhabited gradually curtailed, until at the present day the group is dominant only in regions which malacologically are amongst the weakest and most primitive on the earth, and in great measure still free from invasion and competition by the more highly organized and later developed genera, and therefore constitute temporary sanctuaries for these weaker forms of life, and delaying their ultimate extinction.

The MACROÛGONA is a more highly organized group than the preceding, possessing a large and solid shell, with the ample embryonic whorls well differentiated from the later growths by diverse sculpture or terminal wrinkling. The genitalia are simple, but often bear an epiphallus, and there is sometimes a blind sac or appendicula on the vagina. The eggs are large, and the young hard-shelled at birth. This group is restricted in its distribution and is now confined to the southern and south tropical parts of the Eastern Hemisphere.

SUB-FAMILY EPIPHALLOGONA Pilsbry.

The *Epiphallogona*, of which the *Teleophallogona* is a somewhat more ancient form, is derived from a Protogonous stock, and at the present day is particularly characteristic of Eastern Asia, though also found in the West Indies and the northern parts of South America. It is characterized by the addition of a flagellum and epiphallus to the simple genital system characteristic of the *Protogona*; the appendix, so distinct in the *Teleophallogona*, is absent or vestigial, while the shell is usually solid, with an expanded or reflected lip.

This group which, like the others, probably originated on European soil, has in course of ages been expelled from its original home, and in the Old World is at the present found in South-East Asia, from Japan to India, but now chiefly occupy and are dominant only in the equatorial and tropical islands of the Indo-Malayan region and the adjoining Australian continent, though the advanced guard of the *Euadeniæ* has already also obtained a footing in those countries.

They apparently followed the *Protogona* and invaded America by means of the Behring Bridge, extending southwards along the Pacific coast, and at present occupy the West Indian Islands, Central America, and the northern parts of South America, driving before them the weaker Protogonous and Teleophallogonous predecessors, and been pressed in the rear by the later developed Euadeniate species, but extending beyond them on all sides except along the route by which the newer and stronger race are advancing.

Accepting the relationship implied by the comparison of *Helix oclusa* and *vectiensis* with certain recent species, I have allocated them to the *Epiphallogona*, the group to which their suggested analogues belong, being confirmed in this action by my belief in the probability of the former occupancy of European soil by the ancestral Epiphallogonous forms, and the consequent likelihood of their fossil remains being eventually met with.

GENUS *THELIDOMUS* Swainson.***Thelidomus oclusus* (Edwards).***Helix oclusa* Edwards, Mon. Eoc. Moll., 1852, p. 64, pl. 10, ff. 10 a-e.*Nanina oclusa* Sandb., Vorwelt, 1872, pp. 228 and 294, and pls. 13, ff. 15-15b, and 15, ff. 25-27.*Ariophanta (Rhysota) oclusa* Cossmann, Coq. Foss. Eoc. Paris, 1889, p. 352.

SHELL subglobular, more convex above than below; WHORLS five to six, convex, rapidly enlarging, depressed at the sutures and flattened at the base, the lines of growth faint, oblique and irregular; APERTURE obliquely oval, the ends slightly converging, and the LIP slightly reflected, but basally spread over and entirely closing the narrow UMBILICUS; a brownish-yellow peripheral band encircles the whorls just above the sutural line, the colouring being always preserved.

Diam. 30 mill.; alt. 19 mill.

*Thelidomus oclusus* (Edwards).

FIG. 254.—Frontal and rear aspect of specimens with shell preserved, and showing the peripheral banding (after Edwards).

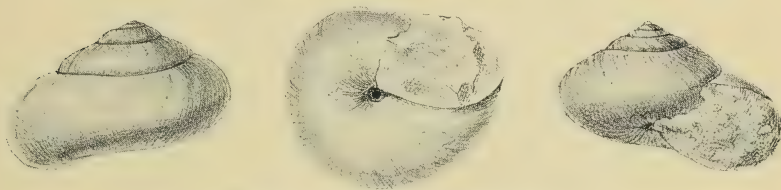
*Thelidomus oclusus* (Edwards).

FIG. 255.—The rear, basal, and frontal aspects of casts (after Edwards).

Mr. Edwards remarks that the species is readily distinguishable when the shell is preserved, but that casts are more commonly found, and these resemble the casts of young *H. globosa*, but may be separated by the oblique columella and flattened base, so different from the tumid base and almost vertical columella of *globosa*, while the smaller number of whorls and narrower umbilicus separate it as clearly from *H. vectiensis* and *H. d'urbani*.

Mr. Gardner remarks on the strong resemblance of this species to *H. incerta* Fér., a native of St. Vincent and the West Indies, while Prof. Sandberger is struck by the similarity not only in form, but in general aspect and banding to *Nanina moussoni*, and Cossmann has directed attention to the similarity of the fawn-coloured peripheral band to that of *Ariophanta monozonalis* of Lamarek.

Upper Eocene—In Germany, according to Prof. Sandberger, it is not scarce at Buxweiler, Alsace.

In France, M. Cossmann records it from the middle sands and limestones of St. Ouen; and fragments of shell from Le Fayel and Berville.

Oligocene—In the Isle of Wight, it is, according to Edwards, not rare at Sconce, in the lower beds of the Bembridge limestone, in which series Mr. Charles Ashford gives Bembridge, Hempstead, Whitecliff Bay, etc., as additional localities.

Mr. Gardner regarded all the Bembridge limestone specimens as young *H. globosa*, and limited *T. oclusa* to the Headon series; although Mr. Edwards in the corrigenda of his work eliminated the Headon record as incorrect.

GENUS *PLANOSPIRA* Beck.***Planospira vectiensis* (Edwards).**

- Helix vectiensis* Edwards, Mon. Eoc. Moll., 1852, p. 62, pl. x., ff. 8 a-e.
 — (*Fruticicola*) *vectiensis* Sandberger, Vorwelt, 1872, p. 290, pl. 17, ff. 1-1 e.
 — *cocciphora* Edwards, MSS.
 — *trochila* Edwards, MSS.

SHELL more convex above than below, the moderately elevated SPIRE composed of about five bluntly convex WHORLS, depressed at the sutures, and thickly covered with minute punctulations. The APERTURE is obliquely semilunar, with a strongly reflected lip, which partially conceals the deep and moderately wide UMBILICUS. In its young state the shell is slightly carinated.

Diam. 10 mill. ; alt. 5 mill.

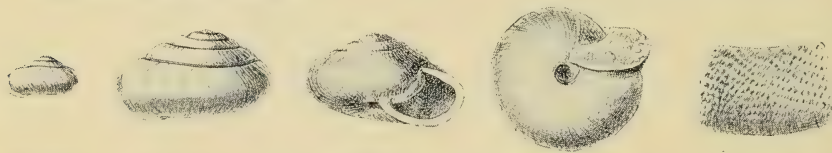


FIG. 256.

FIG. 257.

FIG. 258.

Planospira vectiensis (Edwards).

FIG. 256.—Natural size.

FIG. 257.—Rear, frontal, and basal aspect, $\times 2\frac{1}{2}$.

FIG. 258.—Sculpture of body-whorl, $\times 4$.

Mr. Edwards remarks that casts in the Limnean limestone at Sconce are not uncommon, but that the shell itself is very seldom preserved. The casts are separable from those of *Hyalinia d'urbani*, with which they are most liable to be confused, by the narrower umbilicus, and by the impression of the reflected lip. When the shell is preserved, the punctulate surface is a sufficient distinguishing character.

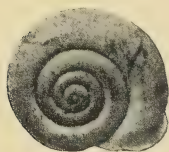


FIG. 259.

Planospira cocciphora
(Edwards ms.), $\times 3$.

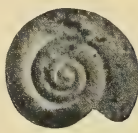


FIG. 260.

Planospira trochila
(Edwards ms.), $\times 3$.

After photographs of Edwards' type specimens in the British Museum.

specimen here reproduced, shows a much more indented suture and rounder whorls than *P. trochila*.

Mr. Edwards compared this species with *H. rufescens* Müller, from which he distinguished it by its less rounded whorls, larger umbilicus, strongly reflected peristome, and pitted surface.

Mr. Gardner has remarked on the resemblance of this species to *Helix fallaciosus* Pfr., from the Island of Ceylon, while Prof. Sandberger placed its relationship with *Helix argillacea* Fér., a native of the Island of Timor.

Oligocene—Isle of Wight : Recorded by Edwards from the Bembridge limestones at Sconce near Yarmouth, and Headon Hill. Mr. Ashford also quotes Bembridge, Hempstead, Whitecliff Bay, etc.

SUB-FAMILY BELOGONA Pilsbry.

The *Belogona* are the most highly developed of the *Helicidae*, and have acquired accessory organs to the reproductive system not previously possessed by the family; these consist of one or more muscular sacs or diverticula developed upon the atrium, within which one or more variously-shaped calcareous spicula are secreted, and in connection with these organs a series of glandular bodies or mucus glands are present. The group is divided into two sections: *Belogona Euadenia* and *Belogona Siphonadenia*.

BELOGONA EUADENIA Pilsbry.

The Euadeniate section is the more primitive of the two groups, and usually possesses, in addition to the organs of the *Epiphalllogona*, a simple dart apparatus with sacculate mucus glands inserted on the dart sac or arising from its base. It attains its greatest development in Eastern Asia, the *Helicostyla*, perhaps the earliest member of the section with their primitive dart apparatus, pressing upon and overlapping the area inhabited by their Epiphallophorous predecessors; the group, however, still lingers in the European region, as one undoubted member—the *Eulota fruticum*—is found in Central and Eastern Europe, the solitary representative of this former dominant race.

Though this group is now a waning one in the Old World, it is the most advanced and dominant group in America, having invaded that country by means of Behring Bridge, and spread southwards, pressing upon the rear of the *Epiphalllogona* which preceded them, and being prevented by the Rocky Mountains from effective eastward extension.

The species found fossilized in the Oligocene and other deposits of this country are here regarded as Euadeniate on account of their similarity to recent Euadeniate species.

GENUS *PLECTOTROPIS* Martens.

***Plectotropis tropifera* (Edwards).**

Helix tropifera Edwards, Mon. Eoc. Moll., 1852, p. 64, pl. x., ff. 3 a-c.

SHELL orbicular, about equally convex above and below, SPIRE slightly elevated; WHORLS five or six, almost flat and somewhat compressed at the periphery, forming a sharp keel; the under-side is tumidly convex, and shows a deep and moderately wide UMBILICUS margined by an obtusely-angled bend. APERTURE transversely lenticular, with a slightly reflected peristome.

Diam. $12\frac{1}{2}$ mill.; alt. 5 mill.



FIG. 261.—*Plectotropis tropifera*, showing upper, frontal, and basal aspects (after Edwards).

Mr. Edwards compares this with *H. lapicida*, but the umbilicus is smaller in proportion, the keel more prominent, and the aperture does not show the deflection at maturity which characterizes *H. lapicida*.

Mr. Gardner thinks the *H. coquandiana* Mathéron, from the Palæotherium limestone of Aude, France, identical with this species, which in size and contour he compares with *H. trichotropis* Pfr., a native of China.

Oligocene—Recorded by Edwards from the Bembridge limestone, Sconce, Isle of Wight. Mr. C. Ashford gives Bembridge, Hempstead, Whitecliff Bay, etc., as additional localities.

GENUS *HELICOSTYLA* Beck.SUB-GENUS *Calocochlea* Albers.***Helicostyla pseudo-globosa* (d'Orbigny).***Helix globosa* Sowerby, Min. Conch., 1818, vol. ii., p. 157, pl. 170.

SHELL globosely-conoid, with a blunt apex; WHORLS six or seven, convex and rounded, with obscure irregular striae or lines of growth, only visible in well-preserved specimens. The base of the shell is very tumid, and abruptly sinks into the UMBILICUS, imparting also an almost vertical slope to the columella. APERTURE obliquely semilunate and depressed, with reflected lip, which at the base entirely conceals the UMBILICUS at maturity.

In the immature stages the shell presents a different appearance to that of the adult, the whorls being very convex and subangulate, increasing rapidly in size, and presenting a subquadrate aperture and a small open umbilicus.

Diam. 32 mill. ; alt. 50 mill.

The measurements given for this species by Mr. F. E. Edwards, judging by the original figures of the shell here reproduced, do not represent the shell as figured, which show an approximately equal diameter and altitude of about 50 millimetres.

The genus *Helicostyla* is very near anatomically to the most primitive Belogonous stock as shown in the simple unsplit and nearly sessile mucus glands. The sub-genus *Calocochlea*, to which Mr. Gardner allocates this species, is a group now inhabiting the Phillipines, New Guinea, etc., and he thinks our species might even be identical with the recent *Calocochlea harfordii*, while Sandberger compares it with *Helix* (*Thersites*) *fraseri* from Cape York, North Australia, but it may be remarked that Dr. Pilsbry suggests the possibility of its being a member of the *H. pomatia* group.

In the fossil state, adult shells are usually imperfect and few specimens are found with the shell preserved, but casts in all stages of growth are comparatively common and in the young state resemble those of *H. occlusa*, but the rounded base, the longer and more vertical columella, and subquadrate aperture distinguish the specimens from *occlusa*.

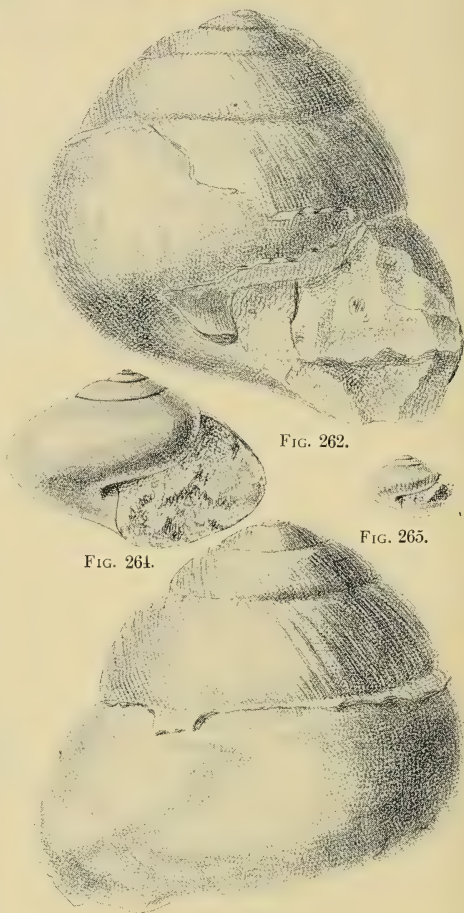


FIG. 263.
Helicostyla pseudo-globosa (d'Orbigny).

FIG. 262 and 263.—Frontal and rear aspect of shell (after Edwards).

FIG. 264 and 265.—Frontal aspect of immature shells (after Edwards).

The *Helix woodwardi* Edwards MS., and *Helix etheridgei* Edwards MS., are, according to Mr. Gardner, probably only young stages of the present species, but it may be noted that in *H. woodwardi* the whorls are not so strikingly expanded laterally as in *H. etheridgei*, and the shell itself is nearly double the size for the same number of whorls, while the suture in *Helix woodwardi* appears deeper and more linear.

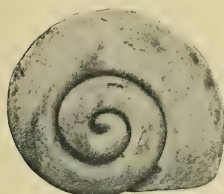


FIG. 266.
Helicostyla woodwardi
(Edwards MS.), $\times 2$.

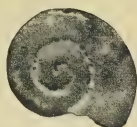


FIG. 267.
Helicostyla etheridgei
(Edwards MS.), $\times 2$.

After photographs of Edwards' type specimens in the British Museum.

herewith from photographs of the type specimens, show shells which are probably immature or not perfectly adult.

Oligocene—Isle of Wight : Recorded by Edwards from the Bembridge limestone at Shalcombe near Ryde and Sconce. Messrs. Newton and Harris quote Headon Hill ; Dr. Mantell, Shalfleet near Yarmouth ; and Mr. Chas. Ashford, Bembridge, Hempstead, Whitecliff Bay, etc.

In South Hants., Dr. Gray records it from the freshwater strata at Hordwell, in company with *Mya*, *Psammobia*, and *Corbula*.

GENUS *EULOTA* Hartmann.

Eulota fruticum (Müller).

Helix fruticum Müller, Verm. Hist., 1774, ii., p. 71.

— *terrestris* Gmelin, Syst. Nat., 1788, p. 3639.

— *lucana* Vallot, Exerc. d'Hist. Nat., 1801, p. 14.

— *schrenkii* Sandb., N. Jahrb. Mineral., 1874, p. 173.

Helicella fruticum Fitz., Syst. Verzeichn., 1833, p. 95.

Bradybæna fruticum Beck, Ind. Moll., 1837, p. 19.

Fruticicola fruticum Held, Isis, 1837, p. 314.

Eulota fruticum Hartm., Gaster., 1840, i., p. 179, pl. 63.

SHELL globular and strong-shelled, with a well-produced SPIRE of about five or six white and convexly-swollen WHORLS, gradually but slowly increasing in size and finely striated in the line of growth ; SUTURE deep and distinct ; APERTURE lunately-rounded, lip sharp and slightly expanded with a weak, whitish and smooth inner rib ; UMBILICUS open and deep. Diam. 20 mill. ; alt. 17 mill.

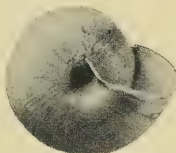
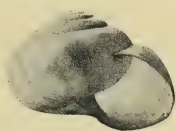


FIG. 268.—*Eulota fruticum* (Müller), showing upper, frontal, and basal aspects (Belfort, Haute Saône, France).

Variation.—This species is also said to be identical with the *Helix carduelis* Reib. and the *Helix cinerea* of Poiret, and is very variable in its colour and markings, many varieties having been discriminated and named ; the large form, 24 mill. in diameter, is named var. *major* by Westerlund ; the dwarf form is the var. *turfica* of Slavik ; the var. *nana* of Sandberger ; and the var. *minor* of Westerlund. The var. *anderssoni* Clessin is a dwarf but depressed form ; the var. *insularum* is also a dwarf, though narrowly umbilicate variety, and a somewhat trochoid form has been named *conica* by Watterbled and *conoidea* by Westerlund.

The colour variations embrace several unicolorous varieties: the var. *cinerea* Poirét, ash-coloured; the var. *rufula* Moq., flesh-coloured, rufous, or corneous (the var. *carnea* Dum. and Mort. being identical with the flesh-coloured form); the var. *rubella* Moq. (the var. *rufescens* of Gallenstein) of a more or less vivid reddish; and the var. *alba* of D. and M. (the var. *albida* of Locard) which is white in colour.

The varieties of colour and markings are numerous, as the var. *stigmatica* Moquin, reddish with black specks and blotches; the var. *mülleria* Moq., yellowish with specklings; the var. *punctata* Moq., yellowish with black spots and blotches; the var. *maculosa* Moq., whitish or horn-coloured with black or red-brown spots and blotches; the var. *fasciata* Moq. (the *unifasciata* of Boettger) whitish or horny with a brown or violet peripheral band; the brown banded form has, however, been separated by Locard as var. *fusco-fasciata*, but if possessing a white ground colour it is var. *albo-fasciata* of Dum. and Mort., or *carneo-fasciata* of the same authors if the ground tint is flesh colour; and the var. *formosa* Moq., yellowish or reddish, blotched and speckled with black and with a purple peripheral band.

Many other local and other variations have also been described:—the vars. *asiatica* and *europæa* by Dybowski, the vars. *aubiniana*, *dumontiana*, *lemoinia*, and *mosellica* by Bourguignat, etc.

Geographical Distribution.—In the recent state, *Eulota fruticum* is widely distributed over the Palearctic region, extending from the Pyrenees and other mountainous regions on the west to Manchuria and Kamtschatka on the east, and M. Locard records it as an inhabitant of Northern Africa.

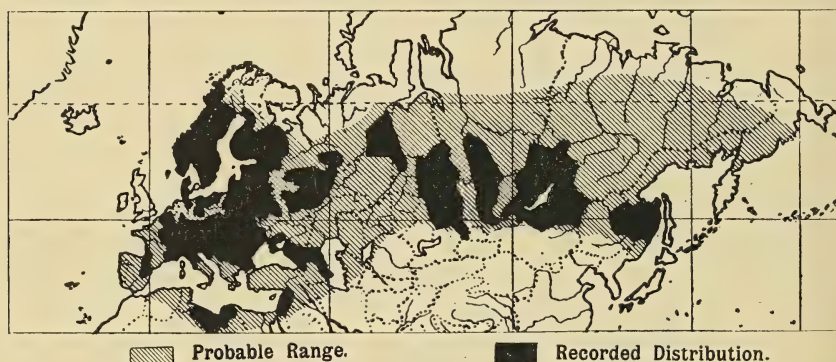


FIG. 269.—Geographical Distribution of *Eulota fruticum* (Müller).

In Germany, it is chiefly found in the east and south, and has been noted from Alsace, Baden, Bavaria, Brandenburg, Cassel, Darmstadt, Upper and Lower Franconia, Holstein, Lorraine, Merseburg, Nassau, Pomerania, East and Rhenish Prussia, Saxony, Silesia, Suabia, Thuringia, Westphalia, Wurttemberg, and the Island of Rugen.

In Belgium, it is reported from the provinces of Hainault, Limburg, Liège, Namur, and Brabant, though now extinct in the vicinity of Brussels.

In France, it is recorded from the eastern and extreme south-western departments, including Ain, Aisne, Ardennes, Aube, Basses Pyrénées, Côte d'Or, Gard, Haute Saône, Haute Savoie, Isère, the Jura, Meuse, Moselle, Nièvre, Nord, Oise, Rhône, Savoy, Seine-et-Marne, Vosges, and Yonne.

In Italy, it inhabits the alpine slopes of Emilia, Lombardy, Piedmont, Tuscany, and Venetia.

In Switzerland, it is well diffused and is known from Aargau, Appenzell, Basle, Berne, Geneva, Glarus, Grisons, Lucerne, Neuchâtel, St. Gall, Schaffhausen, Schwyz, Thurgau, Valais, Vaud, and Zurich.

In Austro-Hungary, it is well distributed in the mountains of Austria, Banat, Bohemia, Carinthia, Carniola, Croatia, Galicia, Goritz, Hungary, Moravia, Salzburg, Styria, Transylvania, and Tyrol.

In Spain, it is recorded from the mountain regions of Aragon, Asturias, and Catalonia.

In the Balkan Peninsula, it occurs in Bulgaria, Roumania, and Servia.

In Scandinavia, it is spread over the southern parts, ascending in Norway as far north as Lofoten; and in Sweden reaching to Qvickjock in Lapland; while in Denmark it is diffused over Jutland and the islands.

In Russia, it inhabits the Baltic provinces, Finland, Kostroma, Kursk, Moscow, Nijni Novgorod, Olonetz, Perm, Poland, Poltava, Riazan, St. Petersburg, Smolensk, Tambov, Taurida, Tschernigov, Voronesh, and the Ukraine; and also Stavropol, Kuban, and Daghestan in Ciscaucasia.

In Asia, it is cited by M. Locard for Syria, and is also found at Barnaul, and the Barabinskisch Steppe, West Siberia; at Riddersk, Buchtarminsk and Irkutsch, in the Altai-Baikal region, and reaches as far as the Amur.

In Africa, M. Locard records it from Tripoli; and Letourneux cites species from Tunis and Algeria, closely allied to, if not identical with our species.

Geological Distribution.—This species is not a common fossil in this country, being quite unknown south of the river Thames, and has not yet been found on the continent below deposits of Pleistocene age.

Pliocene—The unique specimen from the Red Crag, at Page's Farm, Hollesley, East Suffolk, formerly in the possession of Mr. R. Bell and now in the British Museum, was found in 1885, in association with *Linnæa*, *Planorbis*, and marine shells, in a pit near the road occupied as a barnyard.

Pleistocene—First found in the deposit at Stutton in East Suffolk by Mr. S. V. Wood, the original specimen being preserved in the Norwich Museum.

In South Essex, Mr. B. B. Woodward has recorded it from the river drift at Ilford. The record for Copford, North Essex, is, according to Woodward and Kennard, not reliable, and should be expunged.

In Cambridge, it has been found rarely in the gravels at Grantchester, and fairly commonly in those of Barnwell Abbey.

In Germany, it is recorded from the Lower Pleistocene sands of Mosbach, Baden; the Mid Pleistocene loess deposits of Mauer in Elsenzthal and Heigelsbachthal near Würzburg, Franconia; not common in tufa at Cannstadt, Thuringia; and as very rare in the valley loess of Robschütz in Saxony; in tufa of Upper Pleistocene age at Weimar, Burgtonna, and Grafentonna in Thuringia, and at Canth in Silesia; Mr. J. W. Jackson has detected it in loess from Emdingen near Freiburg, Baden; and Prof. Cockerell reports specimens in the museum at Basle from the diluvium at Kiffis, in Upper Alsace; while the var. *nana* Sandberger is found rarely in the loess of Heigelsbach Thal near Würzburg, Franconia.

In France, M. Locard records it from the Upper Pleistocene beds of the Somme.

In Austro-Hungary, it is found in the Mid Pleistocene beds of Nussdorf, Vienna.

In Italy, it is found in the post-Pliocene 'Torbiera' at Polada Lonata, Lombardy.

Holocene—In Belgium, it is not rare in the "Tourbe" at Uccle lez-Bruxelles, though the species is now extinct in the district.

In Germany, it is found very plentifully at Mysleneinnek and Strzelewo in Posen; and in Bavaria, Herr Clessin has found it in the upper beds of tufa at Oberalling near Regensburg, and in those by the Ammersee, Upper Bavaria.

In Denmark, Dr. Johansen quotes it from Zealand in the ancient Neolithic deposits by the Free Harbour, Copenhagen, and on the authority of Elberling, from Maglekilde and Vintermøllen; who also vouches for its occurrence in Jutland at Norlund, Neder Knaberup, Kjærbølling and Skanderborg. Dr. Johansen has also found it in Neolithic deposits at Meilgaard, and in the marl-bed at Gytje; and Collin in the old Neolithic deposit at Ertebølle.

BELOGONA SIPHONADENIA Pilsbry.

This group, which is especially characteristic of the European region, is more advanced in organization than the *Euadenia* from which they have arisen, and contains the most highly-developed *Helices* known, comparing with the white man in their comparative superiority over other races, and possessing the same ability to colonize and dispossess the original occupants of other lands.

In the *Siphonadenia* the dart apparatus of the Euadeniate species has become more perfected, and the sacculate mucus glands have been removed from the dart-sac to a higher position on the free oviduct, and become elongate and of equal diameter throughout or digitate in character, all peculiarities which culminate in the group *Pentatenia*, of which *Helix nemoralis*, *H. aspersa*, etc., are typical, and which represent the most highly organized *Helices* in the world.

The less-advanced and degenerate species may exhibit the dart apparatus and mucus glands in a more or less comparatively vestigial condition, and one or both of these organs may even be quite lost, thus reverting in these respects to the earlier and more primitive condition characterizing their predecessors, the *Epiphallogona*; the true position of such species is determinable only by a study of their developmental history or by the examination of the organization of allied species in which the various stages of the degeneration can be traced and confirmed.

Dr. Pilsbry has remarked that several recent groups, as *Helicella*, *Hygromia*, *Cochlicella*, etc., are genera which have undergone degeneration of certain of the organs of reproduction, resulting in the secondarily simplified forms by which they are characterized, and it is remarkable that frequently the species or groups in which these organs have retrograded are those in which the penis, mandible, radula, and shell show no traces of degeneration, but retain the characters peculiar to the genera from which they are believed to be derived.

Dr. Pilsbry is of opinion that the *Belogona* originated in the East, and that species with reproductive organs similar to those of the early Euadeniate group *Helicophanta*, afterwards spread westward into Europe before or during early Eocene time, and there became modified into the Siphonadeniate type, and splitting up into a considerable number of genera, crowded out of Europe the less-perfected early possessors of the soil, although he further expresses a belief in an interchange of species between Eastern Asia and Europe.

That the Siphonadeniate species have been evolved on European soil, and are not immigrants, can scarcely be confuted; but it is also probable that no immigration from the east ever took place, or any interchange of species between the two extremities of the Eur-Asian tract.

Though in its most highly developed forms this group is especially distinctive of the Western Palearctic or European region, yet certain of the earliest evolved and more simply organized Siphonadeniate species have penetrated eastward as far as China, and represent the advanced guard of the group, mingling with and pressing upon the rear of their Euadeniate predecessors.

GENUS *HELIX* Linné.

(Cochlea, Da Costa ; Helicogena, Férussac ; Pomatia, Leach ; Lucena, Hartmann ; Cœnatoria, Held ; Helicodonta, von Ihering).



HISTORY.—The genus *Helix* (ἑλιξ, a coil) is here associated with the immortal Swedish systematist, Carl von Linné, who first established the present group, and in the year 1758 applied the binomial method of nomenclature to all branches of the animal and vegetable kingdoms, although the system had been partially in use prior to that date by himself and the more advanced specialists of the age.

The group, as defined by Linné, embraced a large number of species, which differed widely in organization and in their shells. These wide limits have been gradually curtailed, and the group is now understood to include only species closely allied to *Helix pomatia*.

This, the typical genus, embraces the most highly organized and adaptable species of the family *Helicidae*, as is evidenced by their dominance and ability

to prosper and increase under many diverse conditions to the disadvantage and detriment of the less-advanced species with which they may be brought into competition.

Generic Characteristics.—The ANIMAL is large, with a tough and granulate skin, showing the paired DORSAL GROOVES, the GENITAL FURROWS, etc., and bearing the REPRODUCTIVE, ANAL, and RESPIRATORY ORIFICES on the right side of the body ; the MANTLE is furnished with distinct prolongations ; the LABIAL PROCESSES are large ; the FOOT fleshy, without distinct SUPRA-PEDAL GROOVES, and the SOLE undivided.

The SHELL varies in shape, but is usually more or less globose, and capable of containing the retracted animal, narrowly umbilicate or imperforate, with about five striate, malleate, or granulate WHORLS, and a discontinuous but reflected PERISTOME. The species of the genus are typically Pentatæniate, or five-banded, although a special modification of this formula may usually be more particularly characteristic of each species and due to the absence, coalition, or splitting of the component bands.

INTERNALLY, the REPRODUCTIVE ORGANS display a compact OVOTESTIS, imbedded in the DIGESTIVE GLAND or LIVER ; a short PENIS, continued as an EPIPHALLUS, to which a RETRACTOR is affixed, and usually terminating in a long and slender FLAGELLUM ; there is a well-developed DART-SAC or stylophore, containing a four-bladed DART and a pair of multifid digitate MUCUS GLANDS, disposed on each side of the FREE OVIDUCT above the dart sac and lying free in the body cavity ; the SPERMATHECA is globose, borne on a long stem, and often furnished with a branch or diverticulum.

The JAW is well developed and odontognathous in type, crescentic in shape, distinctly arcuate, with prominent ribs denticulating both margins.

The dentition is of a generalized type, showing little or no tendency to the specialization exhibited by certain arboreal and other snails, which, by restricting the conditions of life, would debar them from successful dispersion.

Food and Habits.—Vegetation is the staple food of the species of the present group, though they are usually not averse to animal food when obtainable. Although essentially crepuscular in habit, they move about freely during moist weather and after or during rain.

Enemies and Parasites.—The enemies of the present genus are very numerous, embracing not only hedgehogs, rats, mice, and other mammals, but numerous species of birds also prey upon them, while many insects, especially larval *Diptera*, are very destructive, so that were it not that their reproductive powers are so great, it is probable this incessant persecution would lead to their extermination; in fact, the great decrease of *Helix hortensis*, *H. nemoralis*, etc., around some of our larger cities has been attributed by competent observers to the increase of the numbers of thrushes and blackbirds.

The Parasites also are numerous, but have not received the study they merit. The *Leptodermæ* infest the intestinal canal and the salivary glands; *Gregarinidæ* are found in the kidney; while larval forms of various *Distomæ* are of frequent occurrence in the viscera; and a minute flagellate infusorian, *Bodo helix* Leidy, is said to be found in the copulatory tubes of various *Helicidæ*, although their form suggests the possibility of their being really spermatozoa.



FIG. 271.—*Bodo helix* Leidy
× 400 (after Saville Kent).

Geographical Distribution.—The group is essentially European, being dispersed throughout Europe, but it has spread into North Africa, Asia Minor, etc. Most of the species are edible, and are much used for food by the peoples of Southern Europe.



FIG. 272.—Linné's home at Hammarby, near Upsala, now the property of the Swedish Government, and used as a Museum to contain a collection of Linnean portraits and numerous relics (from photograph kindly supplied by Dr. B. Daydon Jackson),

Helix pomatia Linné.

- 1612 *Cochlea terrestris, gypso obserrata* Aldrov., Exang., p. 389.
 1674 — *cinerea, maxima, edulis, cujus os operculo gypseo per hyemem tegitur agri Harfordiensis* Lister, Phil. Trans., no. 105, ix., p. 99.
 1677 — *alba major cum suo operculo* Merret, Pinax, p. 207.
 1678 — *cinerea, maxima, cujus os operculo crasso velut gypseo per hyemem clauditur, Pomatie Gesneri De Aquatilibus*, pp. 244 and 255. Lister, Hist. Anim. Angl. tit. i., p. 111, tab. 2, f. 1.
 1685 — *cinereo rufescens, fasciata, leviter, umbilicata, Pomatia Gesneri*, Lister, Hist. Conch., tab. 48, f. 46.
 1694 — *pomatia edulis Gesneri* Lister, Exerc. Anat., i, p. 162, tab. 1.
 1695 — *alba major* Petiver, Mus., p. 4, no. 12.
 1738 — *opercularis vinearum* Swamm., Bibl. Nat., t. 4.
 1742 — *terrestris vulgaris, maxima, albicans, pomatia*, Gualt. Conch., i., tab. 1, f. a.
 1746 — *testa ovata quinque spirarum, pomatia dicta* Linnæus, Faun. Svec., i., p. 339, no. 1293.
-
- 1758 **Helix pomatia** Linné, Syst. Nat., ed. x., p. 771.
 1774 — *pomaria* Müller, Verm. Hist., ii., p. 45, no. 244.
 1820 — *lucorum* Studer, Kurz. Verzeichn., p. 88.
 1859 — *schliffli* Mousson, Coq. l'Orient, p. 40.
 1778 *Cochlea pomatia* DaCosta, Brit. Conch., p. 67, tab. iv., f. 14.
 1797 — *edulis* Humphreys, Mus. Calonn.
 1826 *Helicogena pomatia* Risso, Hist. Europ. Merid., vol. iv., p. 6.
 1837 *Pomatia pomatia* Beck, Ind. Moll., p. 43.
 1852 — *antiquorum* Leach, Syn., p. 64.
 1837 *Cenatoria pomatia* Held, Isis, p. 911.

*Conrad Gesner.*

is here associated, and who alluded to this shell by the generalized term "De Pomatiis Cochleis."

Diagnosis.—*H. pomatia* differs so greatly in size and aspect from any other British species that there is little probability of confusion arising from erroneous identification, although shells of *H. aspersa* found in connection with Roman camps have sometimes been assumed to be the "Roman snail" and placed on record as that species by archæologists.

HISTORY.—The name *pomatia* (πομία, an operculum) is, according to Dr. Leach, derived from ποματίας, the term applied to the species by Dioscorides (lib. ii., cap. 2), and not from *pomum*, an apple, as some writers have assumed when they speak of the "Apple Snail."

From its large size, striking appearance, and suitability for food, this species has always attracted considerable notice, and has not become overburdened with synonyms, although certain South European forms, originating from the same stock, now generally recognized as distinct species, were probably included with *pomatia* by the earlier writers.

Helix pomatia was first figured in the works of Conrad Gesner, the famous Swiss naturalist, who flourished in the sixteenth century, with whom the species

Description.—ANIMAL large and bulky, usually of a pale yellowish-grey or cream colour, more or less dusky, with large and prominent TUBERCLES, which diminish in size and prominence towards the mantle and the extremities of the body, and are separated by grey interstitial spaces; UPPER TENTACLES or ommatophores very long, clear greyish-yellow, beset with small rounded granulations, and each terminating in a moderately bulbous extremity, bearing the small but distinct black EYE-SPOT; the LOWER TENTACLES are wide apart, and tinged with brownish at the free ends; the MANTLE is of a clear yellowish or creamy tint, extending slightly beyond the shell margin in crawling and showing three lobular extensions, one being the columellar lobule, while the others are near the RESPIRATORY ORIFICE; FOOT ample, obtuse in front, and tapering behind to a fine point.

SHELL globular, thick, solid, and opaque, conically-convex above, and rounded beneath; SPIRE composed of five convex whorls of a yellowish- or whitish-grey colour, with a brown epidermis or PERIOSTRACUM, which is very deciduous, and usually showing three or four somewhat indistinct brownish bands, though occasionally the five bands characteristic of the *Pentatonia* are present; the surface is also irregularly ridged by the lines of growth, and bears a number of somewhat indistinctly incised spiral lines; APEX or nuclear whorl smooth; SUTURE deep and distinct; UMBILICUS oblique and partially concealed by the thickened and reflected columellar margin. APERTURE oblique and broadly lunate, with a thickened, slightly reflected PERISTOME. The EPIPHRAGM which closes the aperture during hibernation is thick, opaque, greyish-white, and cretaceous, convex exteriorly, and formed of many closely-adherent layers. The epiphragm is appreciably less mineralized than the shell, being composed, according to an analysis by Mr. H. Crowther, of 93·16 per cent. of calcareous matter and 6·83 per cent. of organic substances; while M. Delacroix gives 28·03 per cent. of carbonate of lime, 14·77 per cent. of other mineral substances, and 57·20 per cent. of organic matter.

Alt. 45 mill.; diam. 45 mill.; average weight of adult shells about 90 grains.

INTERNALLY, the NERVE RING shows a great concentration and fusion of the medullary ganglionic masses and a consequent obliteration of the commissures connecting them. The pyriform CEPHALIC GANGLIA are so closely connected that the commissure is only indicated by a slight median contraction or narrowing, while the VISCERAL group is fused into one mass, joined by stout connectives to the SUPRA-ÆSOPHAGEAL group.

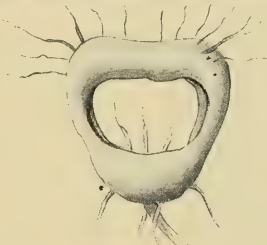


FIG. 274.

FIG. 274.—Nerve ring of *Helix pomatia*, enlarged (after Moquin-Tandon), showing the cephalic and visceral ganglia and connectives.

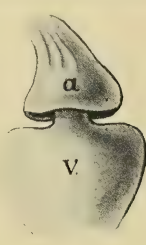


FIG. 275.

FIG. 275.—Heart of *Helix pomatia*, $\times 4$. a. auricle; v. ventricle.

The organs of special sense are well developed, the AUDITORY¹ or equilibrating organs being placed as usual on the surface of the pedal ganglia and containing a large number of flatly-oval OTOCONIA, of concentric and radial structure, though otoconia of other shapes are occasionally found.



FIG. 276.

FIG. 277.

FIG. 278.

FIG. 276.—Front and side view of an otoconium of *Helix pomatia*, highly magnified (after Leydig).

FIG. 277.—Unusual forms of otoconia from the otocyst of *H. pomatia*, highly magnified (after Schmidt).

FIG. 278.—Abnormal forms of the digitate mucus glands of *Helix pomatia*, from Reigate (enlarged).

The EYES² are placed near the tips of the dorsal pair of tentacles, and possess many of the essential constituents of the human eye, a crystalline lens, retina, etc., being present, but the optic nerve enters behind and not as in man, and thus there

¹ Monog. i., p. 150, f. 310.

² Monog. i., p. 150, f. 311.

is no blind spot. Independently, however, of the iconoptic cephalic eyes, the skin itself is sensitive to light or photoskiptic, that is susceptible to sudden illumination and also acutely skioptic or responsive to sudden shading.

The RHINOPHORES¹ or organs of smell have their chief seat at the tip of the tentacles alongside the optical organs, though the anterior tentacles which are similarly innervated are also probably olfactory in function.

The HEART is comparatively large, the muscular salmon-grey VENTRICLE being about double the size of the dull yellowish-grey AURICLE, to which it is joined by a narrow neck.

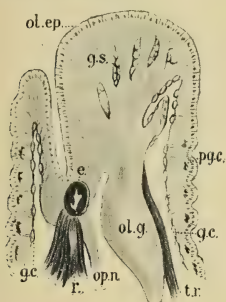


FIG. 279.

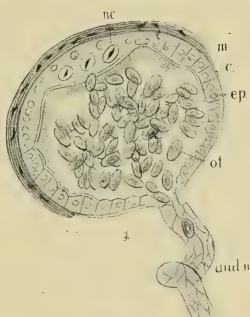


FIG. 280.

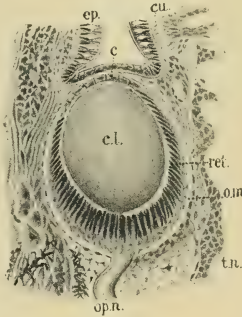


FIG. 281.

Sense organs of *Helix pomatia* L. (greatly enlarged).

FIG. 279.—Rhinophore or tentacular olfactory organ of *Helix pomatia* (after Flemming).
e. eye; g.c. ganglion cells; g.s. ganglionic layer; ol.ep. olfactory epithelium; ol.g. olfactory ganglion; op.n. optic nerve; p.g.c. pigment cells; r. eye retractor; t.r. tentacular retractor.

FIG. 280.—Auditory or equilibrating organ or otocyst of *Helix pomatia* (after Leydig).
aud.n. auditory nerve; c. cuticle; ep. epithelium; m. muscular layer; n.c. epithelium cells with large fusiform nuclei; ol. otoconia.

FIG. 281.—Cephalic eye of *Helix pomatia* (after Simroth).
c. inner cornea; cu. cutis; c.l. crystalline lens; ep. epithelium, constituting outer cornea; o.m. outer membrane or sclera; op.n. optic nerve; ret. retina; t.n. tentacular nerve.

The PEDAL GLAND is compact and slightly thicker behind, with longitudinal ribs and numerous large folds which almost fill the lumen of the gland. A deep groove is seen posteriorly, and the floor of the excretory canal is lined with ciliated epithelium.

The DART SAC or Stylophore² is a pearly-white, stout, and cylindrical sac, rounded at its distal end, with an especially thick and muscular outer coat, and is partially fused with the oviduct.

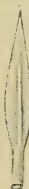


FIG. 282.



FIG. 283.

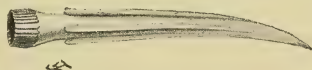


FIG. 284.

FIG. 282.—Immature dart of *Helix pomatia*, showing the inequality of blades during development $\times 6$.

FIG. 283.—Gypsobelum or love-dart of *Helix pomatia*, $\times 6$, with a more highly magnified oblique section showing the character and arrangement of the blades.

FIG. 284.—The vaginal digitate glands and dart sac or stylophore of *Helix pomatia*.

The GYPSOBELUM³ or dart is tetrasthystylous, and is a strong regularly curved glistening and sharply-pointed white weapon, nine or ten mill. in length, and furnished with four equalised and regularly arranged blades (not arranged in pairs, as stated by some authors) with smooth, bluntly thickened edges, which terminate abruptly a little distance from the base, but gradually disappear towards the apex; the pair of blades, however, which presumably represent an ancient distasthystylous condition, are sometimes fully formed before the more recently acquired pair have passed the rudimentary stage; the base is moderately expanded and encircled with

1 Monog. i., p. 151, f. 312.

2 Monog., i., p. 369.

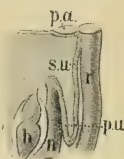
3 Monog., i., p. 366.

an annulus composed of about sixteen regularly arranged rodlets, which cover and fit upon the basal tubercle. Immature darts are frequently met with, and the dart would appear to be a more permanent possession in this than in many species, as they have been found to be invariably present in hibernating specimens.

The RENAL ORGAN or kidney is long and triangular in shape, granular in substance, and pale in colour, and placed in the hinder part of the roof of the lung chamber, adjacent to the pericardium; the URETER is a thin-walled duct, with a doubly-flexed or primary and secondary tract, running near to and alongside the rectum, opening at the margin of the mantle cavity above and to the right of the pulmonary aperture; a special ALKALINE GLAND is also present, which transforms into urate of soda the uric acid excreted by the kidney.

FIG. 285.—Proximal end of Renal organ or kidney, showing the primary and secondary Ureter and the relationship with the rectum, the heart, and the respiratory aperture, highly magnified (after Dr. Arnold Lang).

h. heart; *u.* the proximal end of kidney; *p.a.* pulmonary aperture; *p.u.* primary ureter; *r.* rectum; *s.u.* secondary ureter.



The REPRODUCTIVE ORGANS show a well-developed and compact OVOTESTIS, which is imbedded in the LIVER; the HERMAPHRODITE DUCT is slender, but closely and densely convoluted, terminating in a long and tightly-folded VESICULA SEMINALIS, near the base of the pale brownish and linguiform ALBUMEN GLAND; the OVISPERMATODUCT is whitish-grey; the densely sacculate OVIDUCT being as usual united to the broad and granular PROSTATE or sperm duct; the SPERMATHECA is globular and brownish, and borne upon a very long stem, which only rarely

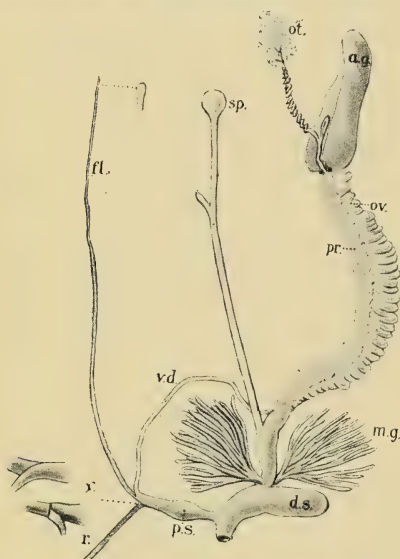


FIG. 286.

FIG. 286.—Reproductive system of *Helix pomatia*, showing the multidigitate mucus glands and the unusual presence of a vestigial or nascent diverticulum or branch to the stem of the spermatheca.

a.g. albumen gland; *d.s.* dart sac; *fl.* flagellum, and enlargement of distal end; *m.g.* digitate mucus glands; *ot.* ovotestis; *ov.* oviduct; *p.s.* penis sheath; *pr.* prostate; *r.* retractor, with enlargements (*x*), showing its mode of attachment to end of epiphallus; *sp.* spermatheca, with stem, showing the unusual feature of the development of a diverticulum; *v.d.* vas deferens.

FIG. 288.—Proximal end of the reproductive system of *Helix pomatia*, laid open to show the internal arrangement and the openings of the ducts, enlarged (after Recluz).

d.s. dart sac, and *d.s.o.* its opening, flanked by the apertures of the digitate mucus glands *m.g.*; *ov.* aperture of oviduct with sphincter; *p.s.* penis sheath; *v.* vestibule.

develops a short branch or diverticulum; FREE OVIDUCT somewhat capacious, with a pair of bluish-white MUCUS GLANDS debouching in front of the dart-sac, each gland being split into thirty to sixty delicate digitate follicles; the VAS DEFERENS enters the penis at the distal end of the short epiphallus, where the long and powerful RETRACTOR is affixed, the EPIPHALLUS being continued as a

FIG. 287.—Base of the albumen gland, showing the Vesicula seminalis and the seminal ducts.

h.d. hermaphrodite duct; *ov.* oviduct; *v.s.* Vesicula seminalis.



FIG. 287

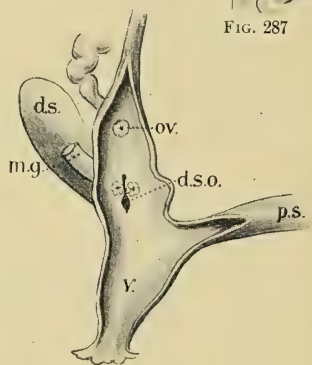


FIG. 288.

very long and slender flagellum, which is slightly swollen at the end; the short PENIS is continuous with the epiphallus, and enters the ATRIUM by a somewhat slender neck.

The ALIMENTARY SYSTEM has the ŒSOPHAGUS partially encircled by the whitish and voluminous SALIVARY GLANDS, beyond which the short canal expands and forms the proventriculus or CROP, followed by the true STOMACH, near to which are the openings of the BILIARY DUCTS from the digestive gland or liver; the INTESTINE is of the ordinary triodromous¹ character, with the usual three distinct flexures or tracts, and terminates by the respiratory orifice.



FIG. 289.—Buccal bulb of *H. pomatia* showing the nerve ring and the right buccal ganglion (after Moquin-Tandon). *m.* mouth; *n.r.* nerve ring; *r.s.* radula sac; *s.d.* salivary duct on the œsophagus.

The JAW or mandible is strictly odontognathous, four or five millimetres wide from side to side, arcuate from front to back, crescentic in shape, and dark brown in colour, without any perceptible median beak or rostrum, but usually with about six widely separated and distinct vertical and parallel ribs denticulating both the upper and lower margins, and six or more subsidiary ridges which extend only partially across the jaw and slightly crenulate the cutting edge. The whole anterior surface is beautifully sculptured with fine and delicate vertical and with sinuous transverse striæ parallel with the upper and lower margins.

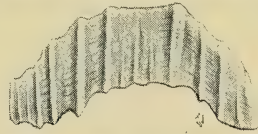


FIG. 290.—Jaw or mandible of *Helix pomatia* L., $\times 10$. (Preston Candover, Hants., collected by the Rev. H. P. Fitzgerald).

The RADULA or odontophore is pale in colour and of the usual elongate form, being about ten mill. long and five mill. wide, and usually possessing about 175 slightly flexuous transverse rows of teeth, each row composed of 159 teeth, and constituted by a median series of narrowly tricuspid teeth, of which the mesocone is broad, strong, and powerful, with a comparatively insignificant ectocone at each side; the laterals are bifid, with an immense mesocone and a well-defined ectocone,



FIG. 291.—Representative denticles from the radula of *Helix pomatia* L., highly magnified (from a preparation by the Rev. Prof. Gwatkin).

the endoconic expansion of the mesocone becoming imperceptibly more pronounced through a series of transitional teeth and at or about the fiftieth row forms a perceptible endoconic cutting point upon the mesocone; the marginals are broad and trifid, the mesocone having developed a distinct endoconic cutting point and being still the largest, though the difference in size has been greatly reduced.

The formula of a Swiss specimen prepared by the Rev. Prof. Gwatkin is

$$\frac{29}{3} + \frac{50}{2} + \frac{1}{3} + \frac{50}{2} + \frac{29}{3} \times 175 = 27,825 \text{ teeth.}$$

The number of longitudinal and transverse rows is, however, in this species eminently variable, a very striking case of this diversity being a Caterham specimen reported by Mr. W. Moss, which possessed 225 rows of 181 teeth each or a total of 40,725 teeth; while Tate gives the formula of the species as 140 rows of 151 teeth each, or 21,140 teeth.

The development of the odontophore in the embryo shows the usual course of evolution,¹ the teeth originating as a few chitinous amorphous nodules, which in succeeding rows increase in number and gradually acquire several sharply pointed



FIG. 292.—A transverse row of teeth from the radula of an early embryonal specimen of *Helix pomatia* L., highly magnified (after Wiegmann).

recurved processes or fangs characteristic of the transitional or echinate stage, and which gradually give place to the simpler type of teeth present in the adult.

Reproduction and Development.—In early spring, shortly after their emergence from their winter retreats, *H. pomatia* proceed to pair, the act usually taking place at night and being always preceded by a series of peculiar actions, which have been carefully observed by Mr. Jackson¹ during his unsuccessful attempts to mate a sinistral specimen with others dextrally organized.

The animals, when seized with the desire for sexual congress, apparently become greatly excited, and when in contact with their prospective partner, they rear themselves up with their footsoles closely appressed together, sometimes reaching with the tentacles a height of nearly four inches from the ground, and being only supported by their tails and the apices of their shells.

When thus reared up they sway from side to side, until their tentacles almost touch the ground, and then slowly resume the vertical position. Then one animal will rear above its partner, and force it slowly back within its shell until only the tentacles are visible; this performance being in its turn repeated by the other snail.

During all these various amatory blandishments the animals emit great quantities of mucus and with every sign of pleasure are continually fondling each other with their tentacles and palpi, their mouths also being in close contact, and a curious sibilant smacking sound being emitted, the copulatory organs are meanwhile exerted from the body, and the love-darts are simultaneously rapidly protruded and withdrawn, frequently crossing each other, and probably irritating and pricking the integument of one or both snails, the darts being eventually torn from their sheaths in the conflict, and becoming entangled with the body mucus are lost.

The eggs, which are deposited shortly after congress, from May to September, are rough and globular, of an opalescent greenish-white when fresh, and about four to six mill. in diameter, the larger size being probably partially due to increase by absorption of moisture from the damp ground; the calcareous envelope gradually becomes of a dull white and so firm that the eggs can be "blown" for preservation, like those of a bird.

They are deposited in clusters of from ten to forty or more eggs, and buried to a depth of two or three inches in the loose moist earth; they hatch in twenty to thirty days, according to the weather; but of a large percentage of the eggs hatched, the young never reach the surface, but die below ground, where their clean and empty shells may be found.

The more vigorous young when hatched are said to make their first meal below ground upon the egg-cases and to have made a considerable growth when they emerge from the earth; the young snails then bearing perfectly transparent horn-coloured shells, about eight millimetres in diameter, at

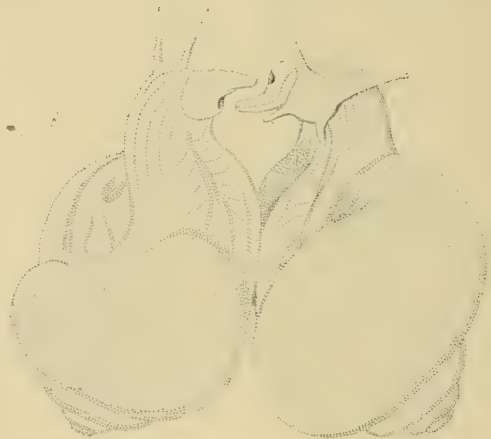


FIG. 293.—Preliminary amatory coquettings of *H. pomatia* (after C. Pfeiffer).

once commence to feed upon any suitable food that may be accessible, and attain a size sometimes considerably superior to that of *H. hispida* before retiring into their winter quarters for hibernation.

On reappearing in the warm days of spring they grow very rapidly and according to the careful observations of Dr. W. A. Gain the shell is usually partially or entirely buried in the soil mouth downwards when its increase takes place; but specimens living on very sandy soils often effect their growth above ground, although such shells are always dwarfed, and never attain the size of those whose growth is made below the surface.

Full growth is usually attained within the year, although some individuals progress much more slowly, taking two or more years to reach maturity.

The life period of this species is about seven or eight years, though it is probable that in a state of nature the bulk of the individuals perish long before attaining that age.

Food and Habits.—*Helix pomatia* is a somewhat geophilous species, seldom climbing trees or walls to any great height; it frequents woods, hedges, old walls, quarries, and uncultivated places, preferring a calcareous ground, though found also on sandy and other soils, but in France lives by preference in gardens, fields, and vineyards.

Though an inhabitant chiefly of the lower-lying cultivated lands, yet it ascends the mountains up to 5,000 feet, living in the pine forests quite to the limit of trees and does not perceptibly decrease in size with the greater altitude at which it lives.

In the gardens it is not nearly so destructive as some other species, preferring as a rule decaying vegetation; a yellow, half rotten glutinous turnip leaf being said to be a particularly favourite morsel. According to Puton, it lives upon fallen fruits, fungi, and various herbs.

In captivity it thrives greatly when fed on lettuce or vine leaves, but readily devours cabbage, horse-radish, French beans, nettles, dandelion, docks, and other plants, and will feed freely upon cooked meats.

On the approach of the cooler weather of the autumnal season, the adult snails, now fat and well nourished, seek out their winter quarters, sometimes nestling beneath dead leaves, or more usually burrowing some inches into the ground, though occasionally they pass the winter with only the shell buried with the aperture level with the surface and directed upwards; when suitably ensconced a thick, convex, and chalky-white epiphragm¹ or lid is secreted exactly fitting the aperture of the shell, and within this a membranous second epiphragm is soon afterwards formed. The fitting of this outer calcareous lid is so accurate that hibernating specimens have been immersed in sea-water for a period of twenty days without suffering injury or apparent inconvenience.

The snail thus lies snugly in a torpid condition until spring, when it pushes off the epiphragm, and breaks its winter sleep, usually in April or

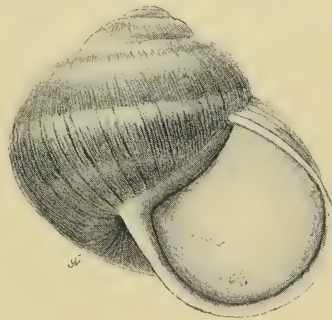


FIG. 294.—*Helix pomatia* with the mouth closed by the calcareous winter epiphragm.

May when, according to Semper, the day temperature has reached 50° to 53° Fahrenheit.

During continued hot and dry weather, this species protects itself almost exactly as from the cold by burrowing a few inches into the soil, and then secreting a solid calcareous epiphragm similar to the hibernial one, and though *H. pomatia* is not inured to long periods of drought, and consequent fasting, like the xerophilous species, yet it has been known to live eleven months without food.

The species is almost immune to many poisons, and though quickly perishing in an atmosphere saturated with camphor, can resist the effects of strychnine, very large doses are however eventually tetanizing as in other animals.

It also possesses very absorbent tissues, and imbibes water not only by the skin but by the walls of the pulmonary sac and digestive tube, the quantity capable of being absorbed exceeding the snail itself in weight.

Though the deposition of pearly matter has seldom been observed in land snails, Mr. L. E. Adams has recorded the finding of a detached almost spherical pearl $5\frac{1}{2}$ by $4\frac{1}{2}$ mill. within or amongst the tissues of a heavy-lipped specimen from Charing, Kent.

Parasites and Enemies.—Little is known of any special enemies, except man himself, but the species is infested by the Trematode, *Cercaria pomatie* Vaney and Conte, which as young flukes, sporocysts, and cercaria are present in the liver or digestive gland.

Protective Resemblance.—Mr. H. D. Gower has remarked on the wonderful protective resemblance which the darker forms of the species present to a knobby growth when, as is sometimes the case, the shells are found adhering to the boles of trees.

Mr. L. E. Adams has also observed that when hibernating with the shell buried in the ground and the whitish calcareous epiphragm level with the surface, the resemblance to a flint stone partially imbedded in the ground is remarkably striking and deceptive.

Economic Uses.—Although *Helix aperta* is the snail held in the greatest repute as a dainty food by continental epicures, yet *H. pomatia* has always been a favourite dish, and even in Roman times was with other species carefully reared and fattened for the table in special snail farms or 'Cochlearia', which were moist and somewhat shady areas surrounded by water, where the snails fed upon the growing vegetation, and were supplied with dressed meats, various aromatic herbs, and bran, flour and other substances boiled in or soaked with wine; this abundance of rich and nourishing food enabled the animals to grow to a large size, and imparted to them a refined and delicate flavour.

This predilection for and prevalence of Helicophagy¹ among the Romans is, however, said not to be due to any special fondness for the food, but to a firm belief in its venereal virtues, and is further evidenced by their use of a special implement called a Cochleare, made from bone, silver, or other material, which though shaped as a spoon at one end was pointed at the other to pick the mollusc from the shell.

In mediæval times the Escargotières were mainly adjuncts to the chateaus and monasteries where the snails were carefully tended and daintily fed, so that the delicacy and flavour they acquired rendered them a much sought for nourishment during the periods of enforced abstinence from flesh food.

¹ Monog. i., p. 424, and ff. 742-744.

At the present day this species is still very largely used for food, more especially in catholic countries, as the Romish Church permits their use as food during the Lenten season.

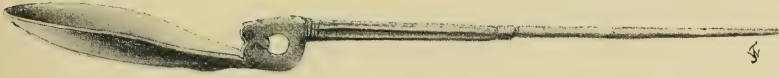


FIG. 295.—Cochleare, or Roman silver spoon, found at Little Horwood, Buckinghamshire, reduced to about half size of original (from Sir John Evans' collection).



FIG. 296.—Cochleare, or Roman silver spoon, found near Woodchester, Gloucestershire, reduced to about half size of original (from Sir John Evans' collection).

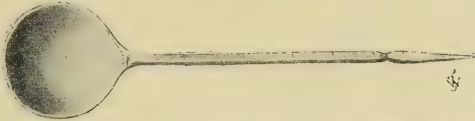


FIG. 297.—Cochleare, or Roman silver spoon, found in the Thames, reduced to about half size of original (from Sir John Evans' collection).



FIG. 298.—Imperfect Cochleare or spoon, formed of bone, and found at Lanuvium, in the Alban Hills, near Rome, three-fourths natural size (photographed by Mr. Henry Crowther from the original in the Savile collection, Leeds Museum).

Snail farms mainly for the cultivation and fattening of this species are even at this day scattered over various parts of Western Europe, and one at Châlet St. Denis near Fribourg, described by the late Mr. Darbishire, which fattens 60,000 to 80,000 *H. pomatia* annually, was constituted by a large meadow fenced in by boards about a foot in height. The snails needed to stock the farm each spring, are gathered by the labourers in the vicinity, and placed in one half of the meadow, and left there until July, when they are transferred to the other half, which is divided by hoardings about a foot in height into numerous squares, like an enormous chess-board; these spaces are filled with moss, the snails being fed therein upon cabbage until they become very fat and of a greenish-white colour; on the approach of winter the snails burrow into the moss, and fix themselves mouth upwards, closing the aperture of the shell with a thick and calcareous winter epiphragm; in this condition they can be exported, and are worth seventeen francs per thousand; some, however, do not form epiphragms, and as they must be used more quickly only realize ten francs per thousand. Paris alone is said to consume fifty tons daily when in season.

The great and increasing use of this mollusc as food and the consequent fear of its extinction led the authorities of Côte d'Or, France, to enact in 1908 a special regulation establishing a close season for this species, and placing it under the protection of the game laws, whereby it was rendered illegal "to shoot, ensnare, and capture it in traps from April 15th to July 15th" in each year.

This taste is said to be also a growing one in England, a restaurateur in Soho, London, estimating that 100,000 snails, mainly obtained from France, are consumed in London every year from October to Easter, and the fashion is spreading to the provinces, where *H. pomatia* if not everywhere actually kept on sale, is imported for such patrons as desire them.

Mr. Kenneth McKean, who for a lengthened period resided in Surrey, often gathered a basketful for home consumption, and assures me that they are a really excellent food.

In the New World this species is more or less regularly imported into New York, San Francisco, and other places in North and South America to supply the tastes of those who desire it for food.

For Culinary purposes hibernating specimens with the epiphragm intact are most suitable, and there are many different modes of preparing them for the table, but they are said to be usually boiled, extracted from the shells, seasoned with parsley, butter, and other piquant seasoning, and replaced in the shells, from which they are eaten.

Other methods are by boiling them in water, they are then taken from the shell and stewed in a saucepan with fresh butter and parsley, or the animal when removed from the shell is three-parts cooked and put in a saucepan with a little water and some butter, or alternatively some broth may be added with a little salt, white wine and vinegar. When cooked quite tender, pour over them a thickening of yoke of egg with chopped parsley, adding nutmeg and lemon juice to make the seasoning more savoury.

When snails are used which have been gathered during their active summer life, it is always desirable to put them aside and deprive them of food for a few days; they should then be placed in a bowl with a handful of bran and a little vinegar to get rid of the slime, and may then be prepared if desired in the Burgundy fashion, by washing in several waters and then placing in a covered saucepan in cold water with a handful of salt a bunch of fennel and two bay leaves, and cooking gently for five or six hours; then remove the shell, eviscerate the animal, and again wash in cold water. Pound up two or three anchovies to a paste, adding four ounces of fresh butter, a few sprigs of parsley, six shallots, and two cloves of garlic, with a pinch each of salt and white pepper, and two pinches of cayenne, then add a little good veal gravy, and mix thoroughly.

Put a little of this forcemeat into each shell, replace the snail, pour over it a little butter, lay carefully on a tin, bake for eight to ten minutes in a hot oven, and serve very hot.

Medicinally, *Helix pomatia* has been held in high estimation for the treatment of consumption and various pulmonary disorders, and Lovell Reeve in his "British Land and Freshwater Shells" gives details of the radical cure of an individual when in the last stages of consumption by the administration of the expressed mucilaginous juice of this snail in jellies and conserves, in gravies, and with entremets of meats.

Even in Martin Lister's time, *H. pomatia* had long been considered as restorative in hectic fever cases.

Among the minor uses to which this species may be put, it may be mentioned that in the Vosges, France, the animal is used as bait for eel fishing, and the shell serves as a trap for earwigs, while the slimy matter left in the shell when the animal is extracted, if mixed with quicklime, makes an excellent cement which is impervious to the action of both heat and humidity.

Geological Distribution.—*H. pomatia* is recorded on the continent from the Pliocene formation, but is better known from the later Pleistocene beds; while in this country it is not known with certainty from below the Holocene or Neolithic deposits.

PLIOCENE.—Prof. Brusina recorded this species as found in a Pliocene deposit in Dalmatia, but as only a single specimen was ever found, the record is doubtful and probably erroneous.

PLEISTOCENE.—Recorded by Sandberger as not common in the Mid-Pleistocene tufa beds of Cannstadt and of Burgtonna, as well as in similar beds of Upper Pleistocene age at Weimar, Burgtonna, and Muhlhausen, all in Thuringia; and by von Ihering from the tufa at Streitberg and Ober Zaunsbach, Franconia.

Mr. J. Wilfred Jackson has also found a fine specimen with dart and epiphragm in fair preservation among loess material from Eudingen, Kaiserstuhl near Freiburg, Baden; and Clessin records immature shells from the Upper Tuffaceous beds near Oberalling, Bavaria.

HOLOCENE.—Hitherto the remains of this species have only been found in the counties of Wiltshire, Surrey, and Gloucester.

In Wiltshire, General Pitt-Rivers records the finding of three specimens in 1882 during the excavation of a Romano-British dyke in Shiftway Coppice near Rushmore.

In Surrey, the Rev. R. Ashington Bullen found fragments of the shell fairly abundantly to the depth of 2ft. 6in. in the Colley Pit, Reigate, remains being found at depths of 1ft. 9in., 2ft., 2ft. 3in., 2ft. 6in., and 2ft. 9in. In the same pit, at a depth of 2ft. 6in., he discovered an early form of flint scraper with undamaged edge of Neolithic age, and beneath this, at a depth of 3ft. 6in., a young shell and fragments of others were found.

Mr. L. E. Adams has found specimens up to a depth of 4ft. in the same deposit, which extends from Box Hill to Reigate, and probably much further. He also found it abundantly in the deposit at Betchworth, commonly in the Horseshoe Pit, but only occasionally in the old chalk pit near Reigate.

Lieut.-Col. Godwin-Austen, about thirty years ago, obtained *H. pomatia* with bones of *Ovis* (sp.) or *Capreolus caprea* and *Equus* at a depth of 2ft. from an Upper Greensand quarry at Reigate, in a mixed deposit of Upper Greensand and Middle Chalk, which though thinner corresponds to that of the neighbouring Horseshoe Pit, and yielded examples of *Terebratulina*, *Rhynchonella*, *Kingena*, *Echinus*, and fragments of *Belemnites* derived from the chalk.

In East Gloucester, according to Mr. I. H. Burkill, many shells have been dug up amongst Roman implements on the site of the Roman villa at Chedworth near Gloucester.

In France, Locard enumerates *H. pomatia* as first appearing in the deposits of the river Saône, and as present in beds dating from the end of the Quaternary epoch down to those of Gallo-Roman times; while Norguet records it as found abundantly at the bottom of a well, filled up during the Gallo-Roman period at Bouvines in the department of the Nord (Norguet, Moll. Nord, 1872, p. 273).

Bouillet records it as found rarely in the comparatively modern cellular Travertine deposits of Auvergne, and in the Aragonite of the cliff called "Gazon," between Coudes and Montpeyroux, Puy-de-Dôme.

Variation.—*Helix pomatia* has been divided into many varieties, but there is little doubt that other and undoubtedly distinct species have at times been confused with it by various authors, this misapprehension is probably the cause of *H. pomatia* being recorded for Southern Italy and Sicily where it is replaced by *H. lucorum* and other species.

Though Puton especially remarks on the selective action of the glands, as shown in its power to secrete a robust shell when living on granitic soils as when inhabiting a limestone district, yet it seems established that the shells from granitic formations in Alpine districts, though of normal size, are really thinner than those found living on the chalk downs.

Dr. Kobelt has also recorded the effect of environment on the size and pigmentation of the shell, and notes that animals living upon calcareous strata secrete larger and more vividly coloured shells than those dwelling upon slate or on sandy soils, and that in the deciduous forests of the Scheerwalde and Falkenstein large darkly pigmented shells are found with beautiful red lips, while in the orchards of Sachsenhausen the shells are mostly brightly coloured and distinctly banded.

Hartmann has also observed that shells from the plains are usually pale in colour and indistinctly banded, while those from the wooded mountain slopes are richly coloured and strongly fasciate.

The usual colouring of the shell is pale fawn, but the epidermis tends to be deciduous and readily exfoliates, thus exposing the whitish calcareous base.

Though *H. pomatia* is a member of the Pentastæniæ group, the usual or characteristic form of the species, according to von Martens, shows only four bands arranged as expressed by the formula $0(23)45$ which indicates a tendency towards the loss of the first band.

H. pomatia may, as to form, be grouped around three chief types: the first, when the height and diameter are about equal, which may be regarded as the form typical of the species; the second, when the altitude exceeds the diameter; and the third, when the diameter exceeds the altitude.

VARIATIONS IN FORM OF SHELL.

Var. **gesneri** Hartmann, Gaster. Schweiz, 1840, p. 105, pl. 29, f. 2.

Helix gesneri Hartmann, op. cit.

Helix pomatia var. *elongata* Pirona, Moll. Friuli, 1865, p. 11.

Helix pomatia var. *pulskyana* Hazay, Mal. Bl., 1881, p. 41, pl. 1, f. 2.

Helix pyrgia Bourguignat in Locard's Prodr. Mal. France, 1882, pp. 83 and 305.

Helix pomatia var. *acuminata* Baudon, Journ. de Conch., 1884, p. 241.

Helix pomatia var. *plagiostoma* Büchner, on *H. pomatia*, 1899.

SHELL with more elevated spire and smaller mouth than the type form.

The var. **gesneri** s.s. is large, conical, and thick, pale and unicolorous or darkly banded.

The sub-var. **elongata** is of an elongate shape, and attains an altitude of 38 mill. and a diameter of 28 mill.

The sub-var. **pulskyana** is globosely conical with raised and pointed spire, $5\frac{1}{2}$ slowly enlarging whorls, and an abruptly deflected aperture. Alt. 45 mill.; diam. 38 mill.

The sub-var. **acuminata** is described as elongate and conical in shape.

The sub-var. **pyrgia** is described by Margier as more elevated and conoid than the type, and Gustav Sayn has discriminated a more conical and a thick-shelled modification, which he named *conica* and *crassa* respectively.

The sub-var. **plagiostoma** is smaller than type, light-brown in colour, with narrow bands, spire elevated and mouth more oblique due to the deflection of the last whorl.



FIG. 299. — *Helix pomatia* sub-var. *pulskyana* (after Hazay).

CONTINENTAL DISTRIBUTION.

Germany—The sub-var. *plagiostoma* is cited for Wurtemberg by Herr Büchner. An elevated form recorded from Oettern in Weimar by O. Schmidt; and Prof. T. D. A. Cockerell found a similar form at Wangen, Baden, in July 1909!

France—The sub-var. *pyrgia* is cited from the department of the Drôme at Die, by M. Arnould Locard; by M. Gustav Sayn from Peyrus, St. Nazaire-le-Désert, Montvendre, and in company with his forms *crassa* and *conica* from Combovin; by M. Margier from the Basses Alpes at Beauvezer in the Upper Verdon Valley, where it ascends to an altitude of 6,000 feet; by M. Beaudouin as abundant at Chatillon-sur-Seine, Côte d'Or; and by Commandant Caziot from the Yonne.

The sub-var. *acuminata* is recorded by Dr. Bandon as not rare in the Oise, at the chalk quarries of Janville and St. Laurent, and on the wooded calcareous slopes of Morainval, near Mouy; and Wattebled says it is rare at Champvans in the Jura.

As *H. gesneri* M. Sayn records it from Grands-Goulets, Montvendre, and Mison near Luc-en-Diois in the Drôme.

M. Bouillet records a somewhat high-spined form in the mountains of Gergovia near Clermont, Puy-de-Dôme; and Bouchard-Chantreaux records a variety with a more slender and pointed spire in the Forest of Boulogne, Pas-de-Calais.

Italy—Sub-var. *elongata* is recorded from Udine in Tuscany by Signor Pirona.

Austro-Hungary—Sub-var. *pulskyana* is recorded by Hazay as inhabiting the islands in the Danube, near Buda-Pesth, Hungary; the var. *gesneri* by Ulicny from Bruun in Moravia; and a var. *conica* is cited by C. Sander from Prague, Bohemia.

Switzerland—Var. *gesneri*, according to Herr Clessin, lives amongst the higher mountains, and a fine conspicuously elevated form is recorded from an altitude of 4,000 feet at Jorogne in Canton Vaud by Charpentier. Hartmann also records it as common in Cantons Ticino, Grisons, and St. Gall.

Var. inflata Hartmann, Erd. u. Sussw. Gast. Schweiz, 1841, p. 105.

Helicogena inflata Hartmann, op. cit.

Helicogena sphaeralis Hartmann, op. cit.

Helix schläflii Mousson, Coq. l'Orient, 1859, p. 40.

Helix eusarcosoma Servain in Sched., 1881.

Helix pomatia var. *solitaria* Hazay, Mal. Bl., 1881, vol. iii., p. 42, pl. 2, ff. 5A, B.

SHELL more globose, spire more depressed and less prominent.

The var. *inflata* Hartmann, s.s., is described as possessing a depressed spire and very swollen last whorl, giving the shell the aspect of *H. aperta*, the last whorl being $\frac{4}{5}$ ths or even $\frac{5}{6}$ ths of the total height.

The sub-var. *sphaeralis* is described as extremely globose, small, and bandless, and resembling *H. lutescens*.

The sub-var. *schläflii* is described by Bourguignat as depressly swollen in shape with an almost concealed umbilicus.

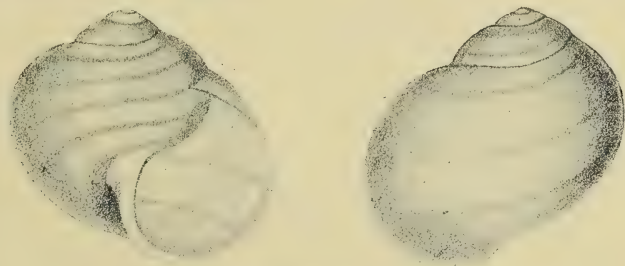


FIG. 300.—*Helix pomatia* sub-var. *solitaria* (after Hazay).

The sub-var. *solitaria* is depressly and tumidly globose, with depressed spire, and four slender dark bands. Alt. $34\frac{1}{2}$ mill.; diam. 38 mill. The *H. eusarcosoma* is a name applied by Dr. Servain to supersede that of *solitaria*.

Dr. Hazay remarks that this variety differs from the type by its depressed form, rendering it broader than high; and by its short flat spire and slender banding.

The figures herewith reproduced from Hazay's original drawings very unfaithfully represent the relative proportions and shape of this form, as will be evident upon comparison of the dimensions and the figure.

CONTINENTAL DISTRIBUTION.

Germany—Büchner cites the var. *inflata* and sub-var. *sphaeralis* for Wurtemberg.

Switzerland—The type specimens of the var. *inflata* were found at the foot of the Lukmanier Pass, Canton Grisons, by Herr Scheuchzer, and the sub-var. *sphaeralis* in the Rheinwald above Nufenen (Hartmann, op. cit.).

Austro-Hungary—Var. *solitaria*, according to Hazay, lives in gardens on the plains near Buda-Pesth.

Balkan Peninsula—*H. schläflii* is recorded by Prof. Mousson from Servia and from Epirus; and by Boettger from the Island of Corfu; while as *Helix eusarcosoma* it is recorded by Dr. Servain as rare around Serajevo, Bosnia.

VARIATIONS IN SIZE OF SHELL.

Var. **gigantea** Porro, Mal. Comasca, 1838, p. 44.

Helix pomatia var. *magna* Stabile, Conch. Lugan., 1845, p. 22.

Helix pomatia var. *grandis* Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 179.

Helix pomatia var. *compacta* Hazay, Mal. Pl. 1881, p. 40, pl. 2. f. 2.

Helix pomatia var. *major* Baudon, Journ. de Conch., 1884, p. 212.

SHELL much larger than the type form.

The var. **gigantea** Porro, s.s., is described as 50 mill. in diameter and 70 mill. in altitude.

The sub-var. **grandis**, according to Herr Büchner, attains a diameter of 60–68 mill.

The sub-var. **magna** is described as having an altitude of 50 mill. and a diameter of 40 mill.

The sub-var. **major** is not less than 50 mill. in height and diameter.

The sub-var. **compacta** is described as globose and thick-shelled, with an elevated spire, and more open umbilicus; whorls $5\frac{1}{2}$, yellowish or whitish-brown, with four broad dark brown spiral bands. Aperture somewhat oblique, and higher than broad, lip thickened and expanded, of a flesh colour, the throat reddish violet; diam. and alt. 55 mill.; aperture 37 mill. high, and 30 mill. broad.

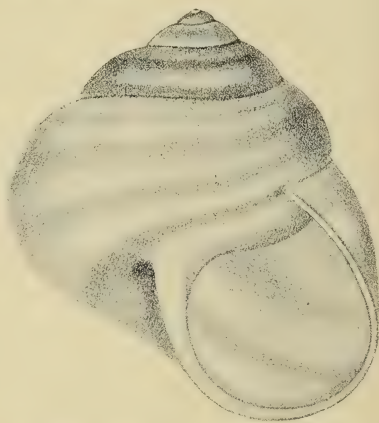


FIG. 301.—*Helix pomatia* sub-var. *compacta* (after Hazay, but reduced to natural size).

Dr. Hazay remarks that in the sub-var. *compacta* the foliicles of the digitate glands are twenty-two millimetres long and about sixty in number, while those of the type are about eighty in number and only five or six millimetres long. These statements are, however, quite incorrect as far as British specimens are concerned.

The figure does not convey an accurate impression of the shell, which Dr. Hazay describes as being fifty-five millimetres in diameter and height; whereas the figure represents a shell with an altitude notably in excess of the diameter.

ENGLAND.

Hants. N.—An enormous shell found at Axford, near Preston Candover, May 1884, Rev. H. P. Fitzgerald.

CONTINENTAL DISTRIBUTION.

Germany—Herr Büchner cites the sub-var. *grandis* from Wurtemberg.

France—Sub-var. *grandis*, rather rare, found at La Jardinette, near Stenay, Meuse (Lepointe and Cardot, Moll. Montmedy, 1903, p. 7); and recorded for Alsace by Meyer. Sub-var. *major* is common in elevated and open sandy places in the Forest of Hez, Oise; and according to Wattebled is also common in the Jura at Mont Poupet, St. Thiebaud, and Chevigny.

Italy—Var. *gigantea*, very common, Valgana, Valle Assine, Monte Resegone, province of Como (Porro, Mal. Comasca, 1838, p. 44).

Austro-Hungary—Sub-var. *compacta* is recorded from Hungary, on the hill-sides, coppices, and forests near Buda-Pesth, by Hazay; and from Tirchova by Prof. Cockerell; while Bielz records specimens nearly 70 mill. in height and 50 mill. in diameter from Transylvania.

Switzerland—Hartmann records that Studer found a specimen in the Convent Garden of St. Urban, 67 mill. in diam. and 65 mill. in height.

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HELIX POMATIA Linné.



Helix pomatia Linné.

Cheltenham, Gloucestershire.

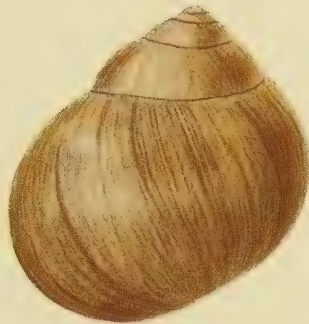
Showing the front and rear aspect, and also the hibernial epiphragm.



Helix pomatia sub-var. *hajnaldiana* Hazay.

Buda Pesth, Hungary.

Darbishire Collection, Manchester Museum.



Helix pomatia var. *brunnea* Moquin-Tandon.

Galloway Hill, Hertford.

A. G. Stubbs.



Helix pomatia var. *fasciata* Porro.

Buda Pesth, Hungary.

Darbishire Collection, Manchester Museum.



Helix pomatia var. *radiata* Ulicny.

Galloway Hill, Hertford.

A. G. Stubbs.

Var. **parva** Porro, Mal. Comasca, 1838, p. 44.

Helix pomatia var. *minor* Dum. and Mort., Moll. Savoie, 1857, p. 94.

Helix pomatia var. *sabulosa* Hazay, Mal. Bl. 1881. p. 42, pl. 2, f. 6.

Helix pomatia var. *parva* Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 179.

SHELL smaller than the type.

Porro, who first distinguished the dwarf form as var. **parva**, gives the altitude of the shell as 41 mill. and the diameter as 35 mill.

Pascal defines the dimensions of Moquin-Tandon's var. *parva* as diameter 34 mill. and altitude 28 mill. ; while Dumont and Mortillet ascribe a diameter of 28 mill. to their var. **minor**.

The sub-var. **sabulosa** has a diameter and altitude of 33 mill. and an aperture 24 mill. high and 17 mill. broad. The shell is described as conically-rounded, with pointed spire, thick and leather-coloured lip, and composed of $4\frac{1}{2}$ slowly-enlarging whorls of a dark yellow colour, encircled by four spiral brown bands.

Dr. Hazay remarks that the vaginal digitate glands of the sub-var. *sabulosa* differ from the normal form in being strikingly small and clustered.

The figure of the sub-var. *sabulosa* reproduced from Hazay does not really represent the true form of this variety, which is described as having an approximately equal diameter and altitude of 33 millimetres, while the figure shows a shell of quite an elongate shape.

This variety, which Hartmann agrees with Charpentier in regarding as arising, amongst other causes, from inhabiting warm low-lying localities, has not yet been recorded for this country, but is on record for France, Belgium, Germany, Italy, Switzerland, and Austro-Hungary.

CONTINENTAL DISTRIBUTION.

Germany—Herr Clessin cites the sub-var. *sabulosa* from Augsburg, Bavaria ; and Büchner the var. *parva* from Wurtemberg. Hartmann records a specimen from Neuwied, Rhenish Prussia, only twenty millimetres in height and twenty-three millimetres in diameter.

Belgium—M. Colbeau quotes this variety from Aywaille near Liège.

France—Sub-var. *minor* cited by Dumont and Mortillet for St. Marcel and St. Triphon in Haute Savoie ; by Pascal from Cénilly in Haute Loire ; for the woods at Raincy, Gagny, etc., in Seine-et-Oise ; as abundant near the banks of the Marne, on the plains of Champigny, and Varenne-St.-Maur, in the department of the Seine ; Dr. Baudon records it from Mony, Oise ; and Wattebled as rare at Genlis, Lonschamp, and Tréclun, Côte d'Or.

M. Puton records a variety half the usual size from the woods of St. Mont near Remiremont in the Vosges ; while Grognot quotes in similar terms the shells found rarely at St. Pantaléon near Autun in Saône-et-Loire.

Switzerland—Hartmann indicates very small examples as inhabiting the Alps of Appenzell, and Mousson found at Airola in Canton Ticino some individuals of this species "scarce as large as a nut."

Austro-Hungary—Sub-var. *sabulosa* in moist shady gardens on the plains around Buda-Pesth in Hungary ; also recorded from Bohemia and many places about Brunn and Boscovitz in Moravia ; and as var. *minor* from Transylvania by Dr. Westerlund.

Italy—Var. *parva*, with altitude of 40 mill. and diameter of 35 mill., is cited for the province of Como by Signor Porro.

VARIATIONS IN SUBSTANCE OF SHELL.

Var. **ponderosa** Baudon, Journ. de Conch., 1884, p. 242.

Helix pyrgia var. *crassa* Sayn, Cat. Moll. Drôme, 1888.

SHELL thick and heavy, usually dull whitish, and almost unicolorous, sometimes weighing nearly 400 grains.

The sub-var. **crassa** is described as possessing a somewhat thicker shell.

Drs. Rawitz and Kossel have demonstrated that in captivity this species may be fed upon paper, and if this be heavily charged with calcic matters, the shell becomes abnormally thickened.

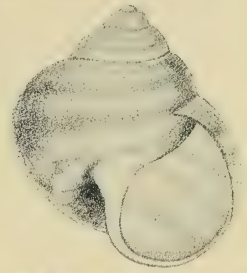


FIG. 302.—*Helix pomatia* sub-var. *sabulosa* Hazay (after Hazay).

CONTINENTAL DISTRIBUTION.

France—Rare in the quarries of Janville, St. Laurent; on the chalky slopes of Coincourt, on Garenne d'Houdainville, and amidst the fields about St. Felix in the department of the Oise (Baudon, l.c.).

The sub-var. *crassa* is recorded from Combovin in the Drôme by M. Sayn.

Brevière alludes to a thick-shelled variety found at the margins of woods on calcareous soil at Lichy and St. Benin-des-Bois, Nièvre.

Austro-Hungary—Bielz records medium-sized but thick shells from Transylvania.

Morocco—The Rev. A. H. Cooke mentions specimens of extraordinary thickness from Fez (Molluscs and Brachiopods, 1895, p. 25); but North Africa being beyond the region naturally occupied by this species, the specimens referred to by Mr. Cooke have originated from introduced European shells.

Var. tenuis Baudon, Journ. de Conch., 1884, p. 242.

SHELL very thin and well coloured, but almost semi-transparent.

CONTINENTAL DISTRIBUTION.

France—Found rarely on the sandstone at Garenne d'Houdainville in the department of the Oise (Baudon, l.c.).

Austro-Hungary—A large and thin variety is recorded by Bielz from various localities in Transylvania.

VARIATION IN SCULPTURE OF SHELL.

Var. costellifera Baudon, Journ. de Conch., 1884, p. 241, pl. 8, f. 3.

SHELL globular and solid, with broad, flat, and prominent transverse ridges.

France—Confined to a small wood crowning a limestone hill at Mouy, Oise (Baudon, l.c.). Dr. Baudon remarks on receiving somewhat similar specimens from Espalion, Aveyron, collected by M. Pons d'Hauterive.

VARIATIONS IN COLOUR OF SHELL.

Var. albida Moquin-Tandon, Hist. Moll. France, 1855, p. 179.

Helix pomatia var. *albina* Spinelli, Mal. Brescia, 1856, p. 6.

Helix pomatia var. *albescens* Lallemand and Servain, Moll. Jaulgonne, 1863, p. 16.

Helix pomatia var. *hajnaldiana* Hazay, Mal. Bl., 1881, p. 41, pl. 2, f. 4.

Helix hajnaldiana Servain, Ann. Malac., 1884, i., p. 350.

Helix pomatia var. *alba* Baudon, Journ. de Conch., 1884, p. 243.

SHELL whitish and unicolorous, with pale straw coloured epidermis.

The sub-var. *alba* Baudon is described as pure crystalline and slightly transparent white, and it is conjectured that the shell may be composed of silica united with carbonate of lime.

The sub-var. *hajnaldiana* is described as of an unicolorous glistening white or yellowish-white, and with a somewhat risen spire. Alt. 38; diam. 33 mill.

This form was at first mistaken by Hazay for the albine variety of *Helix cincta*, to which species it bears a great resemblance.

ENGLAND AND WALES.

Hants. N.—Scarce at Axford, Preston Candover (H. P. Fitzgerald, Journ. of Conch., 1884, p. 204).

Surrey—Near Dorking, July 1885, J. W. Williams.

Reigate, Mr. Brewer (Jeffreys, Brit. Conch., 1862). Box Hill! L. E. Adams.

Herts.—One specimen among a rank growth of nettles, brambles, etc., in a chalk quarry, Puckeridge, Aug. 1882, E. H. Rowe.

Oxford—On grassy bank of railway cutting near Charlbury, on oolitic strata (D. Pidgeon, Q. J. of Conch., 1875, p. 56). Wychwood Forest (Whiteaves, Oxford List, 1857).

CONTINENTAL DISTRIBUTION.

Germany—Three albine specimens recorded in 1876 by Dr. Weinland from the Suabian Alb; and Meyer records it from Alsace.

Belgium—One specimen at Villers-la-Ville in Brabant (Van den Broeck, Bull. Soc. Mal. Belg., 1870, p. 23).

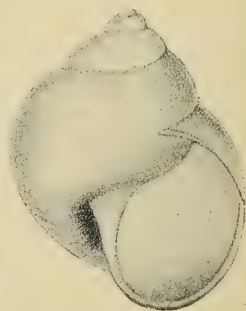


FIG. 303.—*H. pomatia* sub-var. *hajnaldiana* (after Hazay).

France—The var. *albida* is cited by M. Locard as from Bresse, Ain, and the environs of Lyons; by Fagot and Malafoffe as rather common in the Lozère; by Brevière at Lichy and St. Benin-des-Bois, Nièvre; by Dumont and Mortillet from a vineyard at St. Etienne near Bonneville, Haute Savoie; by Pascal as abundant at Cænilly, Haute Loire; Varenne St. Maur, on the plains of Champigny, Seine; in the woods of Raincy, Gagny, etc., Seine-et-Oise, and on the banks of the Marne.

The sub-var. *albescens* recorded by Lallemant and Servain as frequent on the hills about Barzy, Aisne.

The sub-var. *alba* is recorded by Dr. Baudon as found chiefly in Auvergne, but as living also on the wooded calcareous slopes at Balagny, Oise; and Commandant Caziot records it on the authority of M. Guyard from the Yonne.

Switzerland—One specimen is recorded by Dumont and Mortillet found after an examination of 18,000 specimens collected near Geneva; another is recorded by Dr. Brot from the same district associated with *H. nemoralis* var. *albina*; and the Rev. S. Spencer Pearce found a half-grown shell at Borgonuova in the Grisons.

Italy—The sub-var. *albina* recorded from Lombardy by Spinelli as existing at Crinvenni near Brescia; it is also enumerated by Porro for the province of Como; and Mr. J. R. le B. Tomlin found one specimen in Sept. 1886 at Menaggio.

Austro-Hungary—The sub-var. *albina* quoted by Dr. Staudinger from the Tyrol; as var. *hajnalidiana* by Hazay from the botanical gardens and other places near Buda-Pesth, Hungary; and from Croatia and Serajevo in Bosnia by Dr. Servain.

Var. brunnea Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 179.

Helix pomatia var. *unicolor* Westerlund.

Helix pomatia var. *c.* Porro, Mal. Comasca, 1838, p. 44.

Helix pomatia var. *piceata* Gredler, Nachr. Deutsch. Gesellsch., vol. x., p. 18.

SHELL brown, with only very faintly perceptible bands.

The sub-var. *unicolor* is described as unicolorous and bandless.

CONTINENTAL DISTRIBUTION.

France—Abundant on the declivities along the course of the river Marne, in the plains of Champigny and Varenne St. Maur in the Seine; about Cænilly in the Haute Loire, and in the woods at Raincy, Gagny, etc., in Seine-et-Oise (Pascal, Moll. of Haute Loire, 1873, p. 36); Wattebled records it from Auxonne, Côte d'Or; and Locard from near Lyons.

Dr. Baudon records the finding of uniformly coloured shells at Mèrad, Morainval and Uilly-St.-Georges in the Oise; and Dumont and Mortillet also record specimens from St. Trophon, Haute Savoie.

Italy—Enumerated by Porro for the province of Como; by Spinelli as not frequent about Brescia; and Mr. J. R. le B. Tomlin has found quite unicolorous specimens in Sept. 1886 at Menaggio.

Switzerland—The commonest form in the Bergel Valley, Rev. S. Spencer Pearce.

Austro-Hungary—Var. *brunnea* recorded from Hermannstadt, Transylvania, by Bielz; and sub-var. *piceata* from gardens at Arco in the Tyrol.

Var. fasciata Porro, Mal. Comasca, 1838, p. 44.

Helix lucorum Studer, Kurz. Verz., 1820, p. 88.

Helix pomatia var. *b* Charp. Moll. Suisse, 1837, p. 5, pl. 1, f. 1.

Helix pomatia var. *quinquefasciata* Moquin-Tandon, Hist. Moll. Fr., 1855, ii., p. 179.

Helix pomatia var. *bifasciata* Locard, Etud. Var. Malac., 1880, p. 203

SHELL pale, and with distinct spiral dark bands.

The sub-var. *quinquefasciata* has the typical five bands of the *Pentatænia*.

The sub-var. *bifasciata* possesses only two of the normal five spiral bands.

BRITISH DISTRIBUTION.

Surrey—Reigate! Miss F. M. Hele.

CONTINENTAL DISTRIBUTION.

Germany—Dr. Weinland cites 1(23)45, 12(345), (123)(45), 1(23)(45), 12345, 00345, and 00300 as among the various bandings found in Suabia.

Belgium—Cited by Colbeau from Rochefort in Namur; and by Van den Broeck from Villers-la-Ville, one specimen with the formula 123345.

France—The var. *fasciata* is common in the Oise, according to Dr. Baudon, who described a specimen from the woods at Coincourt with seven bands.

The sub-var. *quinquefasciata* is very rare, one specimen found at Salève, in Haute Savoie by Wytttenbach; it is very rare in Calvados, according to de l'Hôpital; it is reported by Pascal from Chemin de Bilhac near the Malanteyre in Haute Loire; by Capt. Wattebled from Auxonne, Côte d'Or; and by Locard from the environs of Lyons and the department of the Ain.

The sub-var. *bifasciata* is rare on the hills of Miribel, Ain, and about Lyons, according to Locard; and is recorded by Wattebled from Auxonne, Côte d'Or.

Italy—Enumerated by Porro for the province of Como, Lombardy.

Switzerland—Three sub-var. *quinquefasciata* found between Sion and Sierre, Canton Valais, by Venetz and Charpentier; and quoted from various localities in St. Gall and Appenzell by Hartmann.

Var. radiata Ulicny, Beitr. Moll. Mähren, 1882, p. 162.

SHELL without spiral banding, but bearing fuscous radiate markings.

Moravia—(Ulicny, l.c.).

MONSTROSITIES.

Monst. turritum Büchner, Jahrb. Ver. Nat. Württ., 1899.

The SHELL is thick and conical, with a produced spire, the last whorl composing half or even only one-third of the total height of the shell.

Germany—This var. was established on Wurtemberg specimens by Büchner.

France—H. Crosse recorded as abnormal, a very elongate bulimoid specimen from the Yonne in the collection of Comm. Morlet, as its peculiar form only began to be assumed after some slight injury to the apical whorls.

Monst. scalare Müller.

Helix scalaris Müller, Verm. Hist., 1774, ii., p. 113, no. 313.

SHELL with the whorls greatly dislocated, and the spire frequently extremely elongated.

CONTINENTAL DISTRIBUTION.

Germany—Gysser records it from Freiburg in Baden; Dr. von Alten has found it at Augsburg, Bavaria; O. Schmidt at Weimar; Scriba at Darmstadt; and Dr. Kobelt at Biedenkopf in Nassau.

France—Portieux (Puton, Moll. Vosg., 1847, p. 31); Grateloup records the form from Valenciennes in the Nord, from the departments of the Drôme, and the Meuse; Albin Gras states that it is rare in the Isère; and Locard records its presence in the vicinity of Lyons, and at Miribel in the Ain.

Switzerland—Charpentier records the form as very rare, and states that one was found at Monthey and two others at Bex. Dumont and Mortillet record the finding of two shells among 18,000 individuals collected in the environs of Geneva.

Austro-Hungary—Noted by Slavik as rare in Bohemia; and by F. J. Schmidt as found near Laibach, Carniola.

Monst. sinistrorsum Moquin-Tandon.

Helix pomaria Müller, Verm. Hist., 1774, ii., p. 45, no. 244.

Helix pomatia c. contraria Férussac, Hist. Moll., 1822, pl. 21, ff. 7, 8.

Helix pomatia var. *sinistrorsa* Moquin-Tandon, Hist. Moll., 1855, p. 179.

SHELL reversed or sinistral in coiling.

Numerous examples of this monstrosity exist in public and private collections, but without precise data as to the locality from whence they were obtained.

ENGLAND AND WALES.

Kent—One specimen labelled "Kent" in the Hunter-Barron Collection, Mason College, Birmingham (W. E. Collinge, Conch., 1892, p. 96).

Surrey—On the margin of the chalk-pit, Oxted, near the escarpment of the North Downs, Sept. 1878! K. McKean. Box Hill, May 1904 (F. B. Jennings, Journ. of Conch., 1904, p. 96). A specimen labelled "Reigate," formerly in the collection of Mr. C. O. G. Napier, is now in the possession of the Rev. R. A. Bullen.

CONTINENTAL DISTRIBUTION.

Germany—A specimen, figured by C. Pfeiffer, found by Dr. Gärtner at Hanau, Nassau. A. Schmidt, in the summer of 1885, found a specimen at Aschersleben; A. Gysser records it from Müllheim in the Breisgau, Baden; and Karl Natermann records two at Offenburg, North Baden.

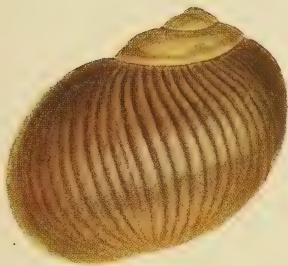
HELIX POMATIA Linné.



Helix pomatia var. *acuminata* Baudon.
Galloway Hill, Hertford.
A. G. Stubbs.



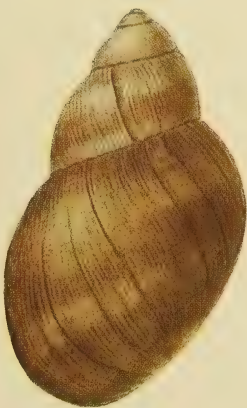
Helix pomatia var. *inflata* Hartm.
Galloway Hill, Hertford.
A. G. Stubbs.



Helix pomatia var. *costellifera* Baudon.
Mouy, France (after Baudon).



Helix pomatia m. *sinistrorsum* Moq.-Tand.
Oxted, Surrey, K. McKean.



Helix pomatia m. *turritum* Büchner.
Yonne, France (after H. Crosse).



Helix pomatia m. *scalare* Müller.
(after C. Pfeiffer).

France—This form has been recorded by Lallemand and Servain from the hills of Charmel, Aisne; from Le Mans in the Sarthe, Verdun in the Meuse, and Paris by Moquin-Tandon; from Vichy in Allier by Grateloup; from the Isère by Gras; from Coursous in the Yonne, by Caziot; as rare at La Bresse, Ain, and about Lyons, by Locard.

Switzerland—Dr. Charpentier records that since 1827 thirty specimens of var. *contraria* have been found about Bex, Canton Vaud (Moll. Suisse, 1837, p. 5); while Dumont and Mortillet found six specimens amongst about 18,000 shells collected in the environs of Geneva.

Austro-Hungary—Two specimens are in the British Museum, labelled as from "Vienna," while Slavik enumerated it as having been found in Bohemia.

Many other varieties have been described of which the descriptions or figures have not been available; as vars. *banatica* Km., *lednicensis* Brnck., *lagarinae* Adami, *segalaunica* Sayn, *poromaca* Bgt., etc., but these are all probably more or less insignificant and uninteresting.

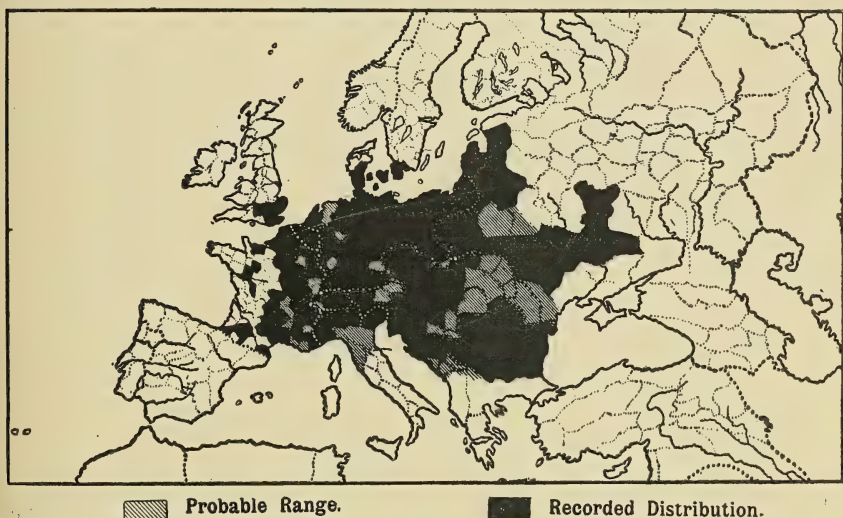


FIG. 304.—Geographical Distribution of *Helix pomatia* Linné.

Geographical Distribution.—*Helix pomatia* is one of the species especially distinctive of Central Europe, its natural range extending from South-east Russia into Eastern France, and from Denmark and South Sweden on the north to the Balkan Peninsula on the south.

This species has at various times been recorded from districts beyond the area now defined, but it is probable that such records represent the descendants of imported specimens, or are due to unprecise identification or errors of locality.

The evolutionary area of *H. pomatia* is evidently the Germanic region, from whence it is gradually extending its range, slowly towards the west into France, where it is probable that many of the widely-detached localities for this species have originated from artificially introduced examples; eastwardly its advance is apparently more rapid and its course of migration full of interest.

In Western Russia it is creeping steadily northward along the shores of the Baltic Sea, while more to the south it has penetrated almost across

the country, its line of advance marking the area intervening between the southern limits of the Boreal region of Milachevich and the northern boundary of the southern fauna of Drouet, and the route is, therefore, strongly confirmatory of the suggested chief line of migration¹ from the European region advocated in the present work.

Beyond the true range of the species, and overlapping its confines, at many points, or isolated in more or less restricted regions, there are, however, several closely-allied species, as *Helix cincta*, *H. ligata*, *H. lucorum*, *H. melanostoma*, *H. radiosa*, *H. obtusata*, etc., which are probably the modified earlier offshoots from a common ancestral form, and, therefore, occupying outlying or detached districts more or less remote from the assumed chief evolutionary area now inhabited by *Helix pomatia*.

In the British Isles, its distribution is distinctly southern, and almost confined to calcareous soils, its metropolis being the Thames valley; it extends westward as far as the Cotswolds, and, according to Mr. Royal Dawson, lives as far north as Norfolk.

It has hitherto been a very general belief that *Helix pomatia* was introduced into this country, as food, by the Romans, this belief being mainly based upon the discovery of its shell among the buried relics of the Roman occupation, and its comparative abundance in a living state in the immediate vicinity of several Roman stations or encampments.

The probability of its importation into this country by them is rendered less probable by the fact that this species is not found near Rome, not having, even yet, spread so far to the south, its place being filled by *H. lucorum*, *H. cincta*, and other allied species, but the discovery of its fossilized remains in several undoubtedly pre-Roman deposits would seem, however, to finally dispose of any doubts of its being really native, and we may, therefore, now regard the species as a true denizen of this country.

Though it is beyond question that very numerous attempts have been made in the past, and even at the present day, to establish this mollusk in districts where it was not known to occur, yet these efforts are almost invariably unsuccessful and there is little doubt that *H. pomatia* originally reached this country by natural means, and that its diffusion over the country has been due to legitimate methods of dispersal with little or no voluntary assistance by man.

ENGLAND AND WALES.

Channel Isles—Messrs. Cooke and Gwatkin record that the late Dr. Lukis endeavoured to colonize *H. pomatia* in Guernsey, though apparently unsuccessfully (Q. J. of Conch., 1878, p. 333).

CHANNEL.

Devon S.—E. Parfitt records finding a single living example by the side of the Exeter Canal in 1862 (now in Exeter Museum!), but thought it must have been an escape (Trans. Devonsh. Ass., 1873-4, vi., p. 634).

Wilts. N.—A single specimen was recorded in 1805 by Colonel Montagu from Devizes, where it has also been found in recent years by Mr. C. D. Heginbotham and Mr. G. Trevor Lyle. Mr. H. Cunningham has also collected it in June 1883 on Roundway Hill, near the same town; Mr. C. N. Bromehead found specimens at the south-east corner of East Croft on the edge of the forest, near Puthall Gate, Marlborough; and Rev. J. E. Vize records it from woods near Chilton and Ramsbury.

Wilts. S.—Rare at Salisbury (J. E. Vize, Wilts. Mag., 1866, p. 279).

Dorset—Not uncommon in Dorsetshire (Da Costa, Brit. Conch., 1778, p. 71).

Hants. S.—Rev. W. H. Hawker attempted to colonize or establish the species at Horndean during 1855 (Linnean Trans., 1855).

¹ Monog. i., 392, and maps.

Hants. N.—Abundant in a field at Axford near Preston Candover, July 1883 ! Rev. H. P. Fitzgerald.

Sussex W.—Recorded by C. Merret in 1667 as found in the county of Sussex. Recorded from the vicinity of Chichester, but the specimens are said to have been obtained in Mr. W. Jeffery's garden at Ratham, and were imported from Surrey. A few dead shells have also been found in a copse upon the downs not far from Petersfield, but according to Mr. J. E. Harting, the specimens found were probably some obtained from Preston Candover and liberated in that locality.

Kent E.—Mr. E. Jacobs, of Faversham, a subscriber to Da Costa's British Conchology, published in 1778, states in a marginal note upon his copy, now in the library of the Conchological Society: "I doubt their being not indigenous, there are plenty of them in my woods at Cader in Ospringe and on the chalkhills thereabouts."

Faversham ! Miss E. B. Fairbrass. Abundant in hedges, coppices, etc., Charing, Sept. 1891, Lionel E. Adams. Near Ashford, 1884, Mrs. Fitzgerald. Stalisfield, Sept. 1885 ! E. Collier.

Kent W.—Moderately plentiful in three localities in the Maidstone district (Elgar and Lamb, Journ. of Conch., 1893, p. 155). Charlton (H. J. Bellars, Cat. Brit. Shells, 1858, p. 16). Chalkhills at Brasted, 1871 ! R. J. Wells. Common, Sevenoaks, 1883 ! A. H. Shepherd. Eynsford, Aug. 1884, T. D. A. Cockerell.

Surrey—Da Costa in 1778 recorded the abundance of *Helix pomatia* all over the downs and in the woods, etc., of Albury, Ashtead, Boxhill, Dorking, and Epsom, ascribing their presence in those places to their introduction in the middle of the seventeenth century by Mr. Charles Howard, a member of the Arundel family (Brit. Conch., p. 71).

Abundant in lanes and woods, Box Hill, Mickleham, and Dorking (D. Cooper, London List, 1836, p. 122). Roadside below Epsom Downs, Apr. 1888 ! W. Whitwell. Common on the chalkhills, Reigate, G. S. and E. Saunders. Red Hill, R. M. Christy. White Hills near Godstone, 1890, F. Reynell. Chalk bank near Limpsfield, March 1891 ; Chelsham, and downs near Headley, March 1893 ; and hedges near Rammer. Common, May 1894, T. D. A. Cockerell. Newlands Corner near Gomshall, June 1894, B. Cole. Barnes Common, C. H. Deadman. Chalk pit, Leatherhead, and Chipstead, C. Pannell. Between Woodmanstone and Waltham, July 1904, A. Christie. Warmingham, 1884, S. C. Cockerell. Croydon, E. Simpson. On sandy soil, Tyting Farm near Guildford, Sept. 1880, said to have been introduced into this district from Italy many years ago by the Earl of Arundel (W. C. Atkinson, Nature, May 1883, p. 81). Wychling near Sittingbourne (E. W. Swanton, Nat. Journ., 1897, p. 19). Caterham (T. A. Dymes, Sci. Goss., Aug. 1894, p. 143).

Mr. K. McKean has pointed out that their true metropolis in Surrey may be regarded as enclosed by a triangle with Caterham, Boxhill, and Tatsfield at the apices, and has himself collected the species abundantly in the woods below Botley Hill Farm near Titsey, in Aug. 1877, and on the short crisp grass covering the chalk heaps in the old quarry at White Hill in 1878. It is found also in the quarries at Godstone, and in a lane near Nutfield Marsh on the Lower Greensand, almost a mile south of the Chalk escarpment. It has also occurred in the road between Smitham's Bottom and Merstham in June 1880 ; at Hallelew Farm near Warmingham in July 1881 ; along a hedgerow at the north end of Coulsdon Common in June 1887 ; and unusually dark specimens in a wheat-field between Perrots Park and Woodmanstone in May 1883.

Mr. W. Whitwell has remarked that living specimens have been released accidentally or purposely about Wandsworth Common and Balham, and this has also probably been done at other places.

Essex N.—Found by Miss A. Agerth on waste land forming the bank of a lane near Chalkney Wood, not far from the Old Priory, Chappel ; Hoe lane, Witham, Mr. Turner ; Chignal Smealey, R. Miller Christy (Wilfred Mark Webb). Two specimens in Saffron Walden Museum from Great Bardfield. Mr. Webb remarks upon these that some years ago the Rev. G. Bailey gave specimens of *Helix pomatia* from a distant locality to some children at Great Bardfield, inferring the possibility of the museum specimens being from the same source.

Herts.—Dr. Martin Lister recorded it as found in fields at Puckeridge and Ware. Amongst a rank growth of nettles, grass, thistles, etc., in a chalk quarry at Puckeridge, Aug. 1882, E. H. Rowe. Abundant about Castlebury, north of Ware, Sept. 1889, W. Turner ; and on the slope of the escarpment at New River Head, on Chadwell Hill, near Ware, June 1883. Braughing (H. J. Bellars, Cat. Brit.

Shells, 1858). Near Marford Bridge, Wheathampstead, by the roadside towards Welwyn, W. S. A. Griffith. Hitchin, 1873, C. Ashford. In chalk-pit, and on railway side near Westmill station, Buntingford. An empty shell found in Verulam Woods, St. Albans (C. F. Leighton, Field, Dec. 1901, p. 950). Chalkpit, Gallows Hill, Hertford, 1904 ! A. G. Stubbs. Locally abundant near Hatfield, and occasionally found at Hemel Hempstead (G. E. Bullen, Trans. Herts. Nat. Hist. Soc., 1907, p. 12). In overgrown chalk pits, Standon ; and at Upwick Green, Farnham (E. G. Ingold, Essex Nat., 1890, p. 216).

Oxford—Not uncommon, especially about Woodstock and Bladen (Da Costa, Brit. Conch., 1778, p. 71).

In a chalkpit between Handborough and Stonesfield (J. Dalton, Nat., 1855, p. 201). Rev. S. Spencer Pearce has collected this species though not plentifully in a copse at Combe Cliff on the outcrop of the Great Oolite and Forest Marble beds ; also fairly plentifully near the site of the Roman villa in the parish of North Leigh ; in a wood at Stockey Hole near Stonesfield, and at Kiddington ; it is also plentiful amongst bushes and herbage about the waste slate heaps at Stonesfield, from which locality it was first recorded in 1853 by Rev. A. Merle Norman. Found abundantly in Wychwood Forest by J. F. Whiteaves in 1857 ; Wychwood Forest ! J. W. Carter, 1909. Recorded by R. Stretch (Zool., 1855, p. 4541), and by others as abundant in Charlbury Forest ; and by D. Pidgeon (Q. J. of C., 1875, p. 56) as plentiful within narrow limits on the grassy banks of the railway cutting at Charlbury.

In 1883 the Rev. S. Spencer Pearce recorded a large and thriving colony in the botanic garden at Oxford, descendants of Stonesfield specimens imported many years ago.

Bucks.—Da Costa in 1778 recorded that Sir Kenelm Digby distributed this species about his residence at Gothurst near Newport Pagnel, but that they were not frequent there (Brit. Conch., p. 71).

Not rare in a park at Great Marlow (H. Ulyett, Sci. Goss., 1883, p. 211). On the chalk downs above the village of Hambledon, South Bucks. (P. H. Stokoe, Nature, May 1883, p. 6).

ANGLIA.

Suffolk E.—In a pit at Bramford, but doubtfully indigenous, Mr. Claude Morley (A. Mayfield, Journ. of Conch., 1909, p. 273). Blaxhall, but said not to be truly native, G. T. Rope.

Suffolk W.—Mr. W. Palmer has discovered a flourishing colony in a large chalkpit at Rickingham ! (A. Mayfield, Journ. of Conch., 1909, p. 273).

Norfolk E.—Amongst ivy on walls, King's Lynn, W. Royal Dawson.

Cambridge—Foulmire (J. Wolley, Zool., 1847, pp. 1821-2). About Shelford (Mrs. McKenny Hughes, Geol. Mag., 1888, p. 206).

Bedford—Chalk hollow near Luton, June 1868 ! W. Whitwell.

Northampton—Said to have been introduced by Lord Hatton into a coppice near his house at Kirby, but the animals all quickly died (Morton, Nat. Hist. Northants, 1712, p. 414).

J. C. of Loughton (Nature, May 1883, p. 31) records that from 1849-52 when living near Woodford he often found *H. pomatia* in a small wood known as Woodford Shrubbery. It was commonly said that General Arbuthnot formed the shrubbery, and brought the shells from abroad about thirty years before.

Plentiful in 1896 about Woodford, near the spot where General Arbuthnot was supposed to have introduced it about fifty years ago (C. E. Wright, Journal of Northants. Soc., 1896, p. 61).

SEVERN.

Gloucester E.—Chedworth Parish and about Frog Mill (Da Costa, Brit. Conch., 1778, p. 71).

Of large size in several woods, Lineover, Witcombe Wood, and Cooper's Hill near Birdlip, etc. (W. Webster, Nat., 1854, p. 175). Rendcombe (J. Bellars, Ill. Cat. Brit. Shells, 1858, p. 16). Hedgebottoms about Gloucester, Oct. 1879, Rev. H. Milnes. Leckhampton Hill near Cheltenham, May 1887 ! and one specimen close to the Roman villa at Chedworth near Gloucester, where many shells have been dug up among the Roman implements, I. H. Burkill. Plentiful at Chedworth, J. R. B. Masefield.

Gloucester W.—Rare at Stapleton, Mr. J. S. Miller (Ann. of Phil., 1822, p. 379). Mr. J. W. Cundall has also found it on the Cotswolds near Gloucester.

TRENT.

Leicester—Mr. J. Plant has recorded that during 1845 a number of specimens were turned out in the grounds of the Collegiate School near Leicester, but only dead shells have since been found.

Derby—Mr. J. Plant has placed on record that in 1833 the Rev. A. Bloxam established a colony on the limestone ground about Calke Abbey, but they do not appear to have flourished, and seem to have died out.

HUMBER.

York N.E.—Mr. W. Bean, of Scarborough, many years ago, placed a number of this species in Forge Valley near Scarborough. In July 1866, some years after their introduction, a living specimen was found there, and in April 1868 another was found. None, however, have been found in recent years (C. Ashford, Mch. 1883).

Mr. Hargreaves records that another attempt at colonization was made in 1868, and though no living specimens have been found for many years, a dead shell was picked up in 1907.

The late Mr. Baines, curator of York Museum, also sought to establish the species in the museum grounds, and in 1883 showed several living specimens at large in the gardens.

LAKES.

Westmorland and Lake Lancashire—Captain Farrer in Aug. 1894 liberated a number of Austrian specimens in his garden at Bassenthwaite, and found a specimen in Nov. 1895 hibernating at the base of the garden wall.

SCOTLAND.

NORTH HIGHLANDS.

Sutherland E.—Mr. W. Baillie placed a number of specimens in his garden at Brora during 1894, and noted them and their progeny during six or more years.

IRELAND.

Dr. Turton in his *Conchological Dictionary* stated that Dr. Rutty in his *Natural History of the County of Dublin*, published in 1772, recorded this as an Irish shell, not uncommon in his time, but according to Mr. W. H. Harvey no statement to that effect is found in Dr. Rutty's work, and there is no doubt that *H. pomatia* is not a native of Ireland.

A few individuals of this species were turned out on the chalk, Belfast, co. Down, in the autumn of 1834, but they did not increase, and after a few months none could be found. It was also of late years introduced from England to other localities in Ireland, as Dalkey Island off the Dublin coast, Youghal, in co. Cork, etc. (W. Thompson, *Ann. Nat. Hist.*, 1840, p. 21).

GERMANY.

This species probably occurs throughout the empire, and the few gaps in its recorded distribution are probably due to dearth of information rather than the absence of the species. It has been cited as inhabiting Alsace, Altenburg, Anhalt, Baden, Upper and Lower Bavaria, East and West Brandenburg, Bremen, Brunswick, Coburg, Upper, Lower, and Mid-Franconia, Hanover, Hesse Cassel, Holstein, Lippe, Lorraine, Luneburg, Lusatia, Magdeburg, Mecklenburg, Merseburg, Nassau, Oldenburg, Osnabruck, Posen, Pomerania, East, West, and Rhenish Prussia, Pyrmont, Reuss, Rhine Palatinate, Saxony, Schleswig, Silesia, Suabia, Thuringia, Weimar, North Westphalia, and Wurtemberg.

FRANCE.

Inhabits chiefly the eastern departments, the inhabited districts being Aisne, Ain, Allier, Alpes Maritimes, Ardennes, Auvergne, Aveyron, Basses Alpes, Cantal, Champagne Méridionale, Côte d'Or, Drôme, Gard, Haute Loire, Haute Marne, Haute Savoie, Hérault, Isère, Jura, Lozère, Meuse, Moselle, Nièvre, Nord, Oise, Orne, Pas-de-Calais, Puy-de-Dôme, Rhône, Saône-et-Loire, Savoy, Seine, Seine Inférieure, Seine-et-Marne, Seine-et-Oise, Somme, Tarn, Vaucluse, Vosges, and Yonne.

The departments Basses Pyrénées, Calvados, Gers, Haute Garonne, Maine-et-Loire, Pyrénées Orientales, Sarthe, and Vienne, from which the species is also recorded, are areas apparently quite detached and isolated from its general range, and have probably been populated from artificially introduced and acclimatized individuals.

NETHERLANDS.

Holland—Recorded from Leyden and The Hague in South Holland by Maitland; and M. Schepmann reports it from Gelderland, Limburg, and South Holland.

Belgium—Well distributed and has been noted from the provinces of Antwerp, Brabant, Hainault, Liège, Limburg, Luxemburg, and Namur, as well as from the Grand Duchy of Luxembourg.

SWITZERLAND.

Apparently diffused throughout the republic, and is known from Aargau, Appenzell, Basle, Berne, Fribourg, Geneva, Grisons, Glarus, Lucerne, Neuchâtel, St. Gall, Schaffhausen, Schwyz, Solothurn, Thurgau, Ticino, Unterwalden, Uri, Valais, Vaud, and Zurich.

ITALY.

H. pomatia has at various times and by various observers been recorded from practically every province of Italy, and from Sicily, but in all probability the species does not really extend south of Tuscany, and the numerous records from the southern provinces are really due to the confusion of the present with other of the more closely-allied species, undoubtedly existing there, and from which some of its variations are only with difficulty separable.

By various authors it has been recorded from Abruzzi, Calabria, Campania, Umbria, and Sicily, but its occurrence in those districts is discredited by the most modern writers.

It undoubtedly occurs naturally in Liguria, Lombardy, Piedmont, and Venetia, and probably also in Emilia and Tuscany; but though it may have been picked up in more southerly localities, it has in all likelihood been imported from the more northern districts.

AUSTRO-HUNGARY.

Probably diffused over the whole empire, and has been reported from Austria, Banat, Bohemia, Carinthia, Carniola, Dalmatia, Galicia, Goritz, Hungary, Istria, Moravia, Salzburg, Styria, Transylvania, and Tyrol.

SPAIN.

H. pomatia has been recorded doubtfully from Aragon by Asso, and by Ramis from Minorca; but, according to Prof. Hidalgo, this species is certainly not found on the Balearic Isles, and, judging only from the vernacular name given by Ramis, it is probable that he had *H. pisana* in view.

SCANDINAVIA.

Norway—Though this species has been several times artificially introduced into the Botanic Garden at Christiania, and recorded as living there, it has never prospered and quickly dies out. Miss Esmark has also put on record that in 1885 she liberated a number of Swedish specimens in the park at Jarlsberg.

Sweden—This species was said to have been introduced by Linné into his garden at Hammarby near Upsala, and has been placed in other districts by various naturalists.

Naturally or artificially introduced, it is recorded as existing abundantly in many places in Skane, in the Botanic Gardens of Lund, in a park and in gardens at Stockholm, at Christianstadt, in orchards at Rabeloss and Backaskoga, and at Gransbo by Säby, Smaland.

Denmark—According to Dr. A. C. Johansen, this species is diffused over the eastern and southern districts, being known from the Islands of Funen, Laaland, Moen and Zealand, and from Aarhus and Ribe Stifts in South-East Jutland. It is not as yet recorded for Bornholm or Western and Northern Jutland. Danish scientists differ in opinion as to whether its presence is due to natural dispersal or to artificial introduction, but the compact and continuous area of its distribution point strongly to its natural diffusion.

Distribution of *Helix pomatia* Linné

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

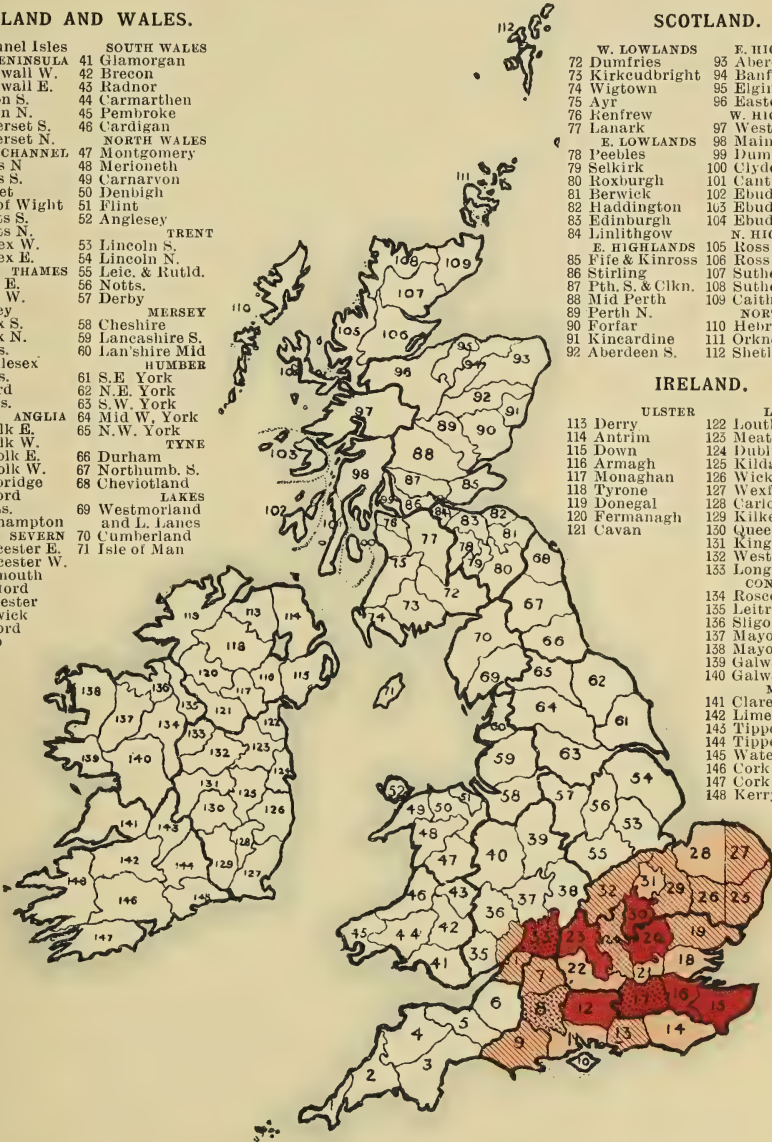
Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilt N.	48 Merioneth
8 Wilt S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Heris.	60 Lancashire Mid
21 Middlesex	HUMBER
22 Berks.	61 S.E. York
23 Oxford	62 N.E. York
24 Bucks.	63 S.W. York
ANGLIA	64 Mid W. York
25 Suffolk E.	65 N.W. York
26 Suffolk W.	TYNE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Hunts.	69 Westmorland
32 Northampton	and L. Lanes
SEVERN	70 Cumberland
33 Gloucester E.	71 Isle of Man
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easterness
76 Renfrew	W. HIGHLANDS
77 Lanark	97 Westernness
E. LOWLANDS	98 Main Argyle
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Pth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

Distribution of *Helix pomatia* Linné

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilts N.	48 Merioneth
8 Wilts S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid
21 Middlesex	HUMBER
22 Berks.	61 S.E. York
23 Oxford	62 N.E. York
24 Bucks.	63 S.W. York
25 Suffolk E.	64 Mid W. York
26 Suffolk W.	65 N.W. York
27 Norfolk E.	TYNE
28 Norfolk W.	66 Durham
29 Cambridge	67 Northumb. S.
30 Bedford	68 Cheviotland
31 Hunts.	LAKES
32 Northampton	69 Westmorland
SEVERN	and L. Lancs
33 Gloucester E.	70 Cumberland
34 Gloucester W.	71 Isle of Man
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easternness
76 Kenfrew	W. HIGHLANDS
77 Lanark	97 Westernness
E. LOWLANDS	98 Main Argyle
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Caithre
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Pth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

BALKAN PENINSULA.

Recorded as extending over the northern and western districts, including Bosnia, Bulgaria, Serbia, and also in Greece, about Mount Pindus, Thessaly; while a var. *schlaftii*, a somewhat globosely ventricose form with dark peristome and parietal wall, ascribed to this species, is cited from Serbia, Epirus and Corfu.

RUSSIA.

Krynicky has recorded this species as diffused over South Russia, but according to his own and other records, this is by no means an accurate statement, as it would appear to be absent from the extreme south.

Kaleniczenko quotes Moscow as a locality for *H. pomatia*, but this is probably an error, as Milachevich in his exhaustive account of the mollusca of that district especially emphasizes the fact that the characteristic feature of the Moscovian region is the total absence of *Helix pomatia* and the larger *Helices*.

It is, however, recorded for Courland, Esthland, Kharkov, Kiev, Kovno, Kursk, Livonia, Lithuania, Orel, Poland, Podolia, Poltava, Vilna, and Volhynia, and has also been recorded from Transcaucasia, where it has probably been introduced.

ASIA MINOR.

Mr. J. Bliss reports the occurrence of this species at Priene near Smyrna; Mr. Gude possesses shells from Trebizond; and a var. *duschekensis* is established by Dr. Kobelt for specimens collected at Duschek near Tiflis.

NORTH AFRICA.

Morocco—Rev. A. H. Cooke cites remarkably heavy specimens from Fez; but these also are probably not truly native shells.

NEOTROPICAL REGION.

Argentina—In March 1892, Dr. W. H. Rush recorded that he found the British Cemetery at Buenos Ayres swarming with *Helix pomatia*, evidently the progeny of some imported specimens.

Uruguay—Mr. Gude has obtained specimens from Monte Video.

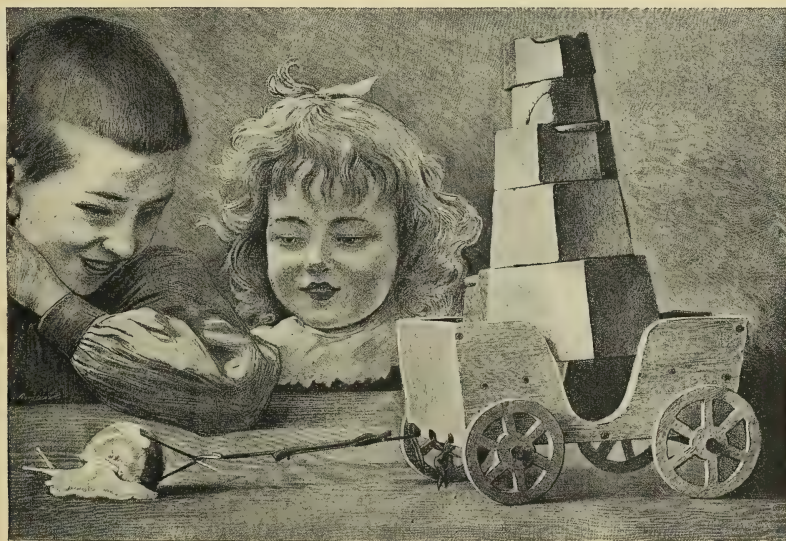
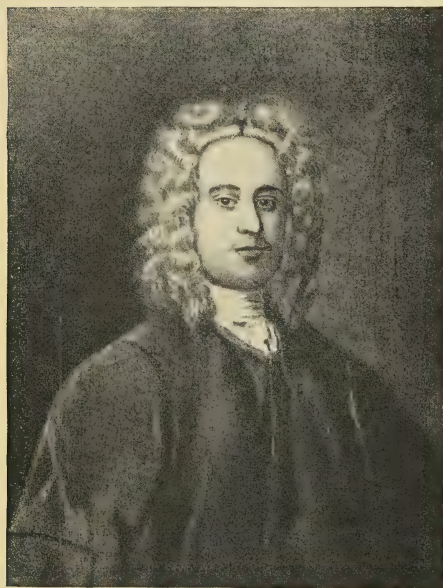


FIG. 305.—*Helix pomatia* drawing a burthen of over nine pounds (four kilogrammes).
(Reproduced, by permission, from L'Illustration, April 13, 1901.)

SUB-GENUS *Cryptomphalus* Agassiz.***Helix aspersa* Müller.**

- 1674 *Cochlea vulgaris major, hortensis, maculata et fasciata* Lister, Phil. Trans., vol. ix., no. 105, p. 99, f. 5.
 1678 *Cochlea vulgaris major, julla, maculata et fasciata, hortensis* Lister, Hist. Anim. Ang., p. 113, pl. ii., f. 2.
-
- 1774 *Helix aspersa* Müller, Verm. Hist., ii., p. 59, no. 253.
 1777 — *hortensis* Pennant, Brit. Zool., iv., p. 136, pl. lxxxv., f. 129.
 1789 — *lucorum* Razoum., Hist. Nat. Jorat, i., p. 274.
 1789 — *grisea* and *variegata* Gmelin, Syst. Nat., p. 3650.
 1832 — (*Helicogena*) *aspersa* Férussac, Hist. Moll. Terr. et Fluv.
 1837 — (*Acacus*) *aspersa* Gray's Turton's Man., p. 128, pl. iv., f. 35.
 1855 — (*Cryptomphalus*) *aspersa* Moq.-Tand., Hist. Moll., ii., 174, pl. xiii., ff. 14-32.
 1861 — *spumosa* Lowe, Ann. and Mag. Nat. Hist., vii., p. 111.
 1778 *Cochlea vulgaris* Da Costa, Test. Brit., p. 72, pl. iv., f. 1.
 1797 — *restitutoris* Humphrey, Mus. Calonn.
 1837 *Cænatoria aspersa* Held, Isis, p. 911.
 1866 *Pomatia aspersa* Tryon, Amer. Journ. Conch., ii., p. 322.



Martin Lister

synonyms of *aspersa* with those of *hortensis*, not considering the former as an English shell, and therefore quoted this shell of Lister, Pennant, and Da Costa for *hortensis*.

This species is dedicated to the memory of Dr. Martin Lister, F.R.S., the author of the first systematic account of the British land and freshwater mollusca and one of the illustrious trio of British naturalists, who—a century before Linné—investigated the biological sciences upon modern scientific lines; Dr. Lister's own investigation of the mollusca taking full cognizance of the internal structure of the animal as well as the external morphology of the shell.

HISTORY.—*Helix aspersa* (*aspersa*, besprinkled) has been regarded by some authors as the *Helix lucorum* of Linné; while Gmelin, who edited the thirteenth edition of Linné's "Systema Naturæ," referred our species to *Helix grisea*, and it may be noted that Mr. Hanley, who so thoroughly investigated the Linnean cabinet of shells, found a box of shells therein of *Helix aspersa* labelled *Helix grisea*; he, however, points out that the Linnean diagnosis of that species does not agree with living specimens of *aspersa*, though not untrue of dead and bleached individuals, and suggests that the name *grisea* be abandoned.

Mr. Rimmer hazarded the probable suggestion that the name *aspersa* applied to this species by Müller was a slip of the pen for *aspera*.

Colonel Montagu has remarked that Dr. Turton has confounded the

We are indebted to Mr. R. W. Goulding, of Louth, for the opportunity of reproducing the autograph and the only known portrait of Dr. Lister.

Diagnosis—*Helix aspersa* is, with the exception of *H. pomatia*, much the largest of our native snails, and though so distinct in its character, has been frequently confused with and recorded for that species by archæologists and others.

From *H. pomatia* it may be known by its smaller shell, less convex whorls, darker colouring, and the rough shagreening of its surface, as well as by the flat, brownish, and almost membranous epiphragm.

INTERNALLY, it is distinguished by the long diverticulum to the stem of the spermatheca, the lesser number of digitations to the stylophoric mucus glands, and the presence upon the gypsobelum or love-dart of a series of crescentic films between the blades, which are quite absent in *H. pomatia*.

Description.¹—The ANIMAL is somewhat bulky, oblong in shape, bluntly rounded in front, and attenuated to a point behind; it is usually of a blackish-grey on the upper surface, though occasionally found of other and paler tints, with about fourteen oblique rows of irregularly oblong TUBERCLES on each side, the summits of which are perceptibly paler; towards the FOOT-MARGIN, the junction with the mantle and the hinder part of the BODY, the colouring is less dark with often a greenish or yellowish tinge, and the granulations become rounder and closer; the paired DORSAL GROOVES, which extend longitudinally along the middle of the back, are well defined, and enclose a row of more elongate and noticeably paler tubercles, but these furrows do not, as in certain *Limaces*, terminate in distinct facial grooves; the genital or lateral furrows extend on the right side from the RESPIRATORY to the GENITAL ORIFICE, and on the left side occupy a corresponding position; the UPPER TENTACLES are long and slender, with distinct bulbous extremities; the LOWER TENTACLES are shorter, being about one-fourth of the length of the upper pair, and almost uniform in thickness; the MANTLE is blackish-grey, closely and finely sprinkled with pale greyish-yellow, and visibly fringing the mouth of the shell when the animal is in motion, but its margin is usually coloured in a manner corresponding to the markings of the shell.

The EPIPHRAGM is brownish-grey or greenish-grey in colour, and parchment-like in substance, except a small area immediately in front of the respiratory aperture, where it is thickened by an opaque-white deposit of lime.

The SHELL is composed of $4\frac{1}{2}$ to 5 whorls, usually more or less obliquely-globose, and opaque, with a yellowish or fawn ground colour due to the investing epidermis, and irregularly banded and marbled with a more deeply-seated blackish-brown pigment; the ordinary character of the banding being indicated by the formula 1(23)45; the sculpture is constituted by strong growth lines, and a plexus of coarse, irregular, and deep wrinklings, which resemble shagreen, and become stronger and more rugose as growth proceeds; the delicately incised spiral lines of *H. pomatia* are not present in *aspersa*. The embryonal shell or apex, consisting of about $1\frac{1}{2}$ whorls, is smooth, pale and uniform fawn colour, the post embryonal growth only gradually developing the distinctive sculpture and markings of the species. The lip is reflected and white, but sometimes tinted with a fugitive pink, and in unusually darkly pigmented shells it is occasionally pinkish-purple; but these tints are not permanent, and quickly fade on the death of the animal. The UMBILICUS is quite open in half-grown shells, but at maturity is entirely covered by a fold and thickening of the pillar lip, and gives rise to the subgeneric name *Cryptomphalus*.

The height and diameter average 35 mill.; and the weight about 30 grains.

¹ Refer to vol. i., p. 144 et seq. for fuller descriptions and figures of the general organization.

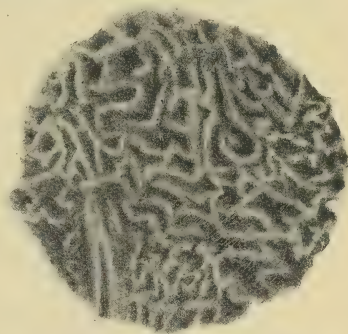


FIG. 307.—Shell sculpture or rugosity of the body-whorl of *Helix aspersa*, enlarged.

INTERNALLY, the NERVOUS SYSTEM¹ in this and other highly-organized species is better and more conveniently studied in immature animals when the component ganglia of the nerve ring are most easily distinguishable, as at maturity the separate parts become fused together and their limits indistinct.

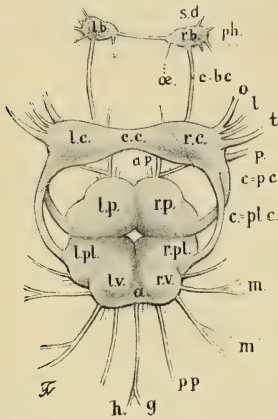


FIG. 308. — Nerve centres from a half-grown *Helix aspersa*, to illustrate the relative positions of the various ganglia and the origin and distribution of the chief nerves; highly magnified.

a. abdominal ganglion; r.b. and l.b. right and left buccal ganglia; r.c. and l.c. right and left cerebral ganglia; r.p. and l.p. right and left pedal ganglia; r.pl. and l.pl. right and left pleural ganglia; r.v. and l.v. right and left visceral or pallial ganglia; c-b.c. cerebro-buccal connective; c-p.c. cerebro-pedal connective; c-pl.c. cerebro-pleural connective; c.c. cerebral commissure; a.p. anterior pedal nerve; g. nerve to ovotestis, with h. branch to heart; l. nerve to lips; m. to anterior and m' to posterior portion of mantle; o. to ommatophore; æ. to œsophagus and stomach; p. to penis or male organ; ph. to pharynx; p.p. to posterior part of foot; s.d. to salivary ducts; t. to lower tentacle and lips.

The CEREBRAL GANGLIA or brain is much blended in adults, and bilobed or cleft at the outer margins, the parts are united by a very stout COMMISSURE, and give nerves to the sensory organs. The PEDAL GANGLIA are a pair of closely-apposed nervous masses, this approximation being so intimate that the commissure is to all appearance quite lost. The VISCERAL or PARIETO-SPLANCHNIC centre is constituted by five medullary masses, which, though more distinct when young, become in adult life agglomerated together, not only amongst themselves, but with the neighbouring pedal centre; this visceral centre not only innervates the body wall, the mantle, and the viscera, but controls the sympathetic nerves which regulate the involuntary motions of the various organs. The BUCCAL or STOMATO-GASTRIC GANGLIA are small and widely-separate nerve masses, which do not fuse together; they innervate the mouth, stomach, etc., and are joined to the brain by pigmented connectives.

The OLFACTORY, the VISUAL, and the AUDITORY ORGANS are each well developed.

The MUSCULAR SYSTEM is most strikingly exemplified in the COLUMELLAR RETRACTOR, which is the most important muscle of the body, and is affixed at its distal end to the columella of the shell, near the commencement of the penultimate whorl, passing beneath the lung chamber, and dividing into a multitude of fibres which interlace with the tissues of the foot; near its origin, this muscle gives rise to the paired TENTACULAR RETRACTORS, each of which about midway of its course gives off a broad and powerful tripartite muscle to the anterior part of the foot; the retractor of each ommatophore expands considerably within the tentacles, and gives off a branch to the lower tentacle of its side, which sends a slip to the lips; the PHARYNGEAL RETRACTOR is a powerful ribbon-like muscle, which also originates from the columellar muscle adjoining to and immediately in advance of the paired tentacular muscles, and divides before reaching the buccal bulb, to which it is attached laterally and ventrally by divided and expanded ends.

The LYMPHATIC GLANDS are not strictly localized in *H. aspersa*, but diffused amongst the connective tissue in various parts of the body, but especially about the pulmonary vessels.

The PEDAL GLAND is, according to Prof. André, similar to that of *H. pomatia*, but has a unique peculiarity amongst our indigenous pulmonates in having the three median folds on the roof of the excretory canal, densely covered with very short cilia, about 0.004 mill. in length.

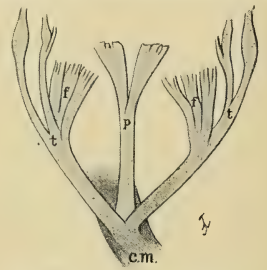


FIG. 309. — Cephalic retractors of *Helix aspersa*, $\times 3$.

c.m. columellar muscle; f. anterior foot retractors; p. pharyngeal or buccal retractor; t. tentacular retractors.

The REPRODUCTIVE SYSTEM is constituted by the OVOTESTIS, an aggregation of digitate whitish lobules lodged in the posterior lobe of the liver near the apex of the shell; the HERMAPHRODITE DUCT, a sinuous convoluted tube, expanded in the middle of its course, but gradually contracting on approaching the large linguiform and yellowish ALBUMEN GLAND, and bending abruptly on itself, forms a subclavate sac, the VESICULA SEMINALIS or claw; within the albumen gland the ova become enveloped in its viscid secretion; the OVA and the SPERMATOZOA are then mechanically divided and flow in separate but closely apposed channels; the UTERUS is of a clear bluish-white colour, with strongly sacculate and voluminous glandular folds, but the walls of the PROSTATE or sperm duct are constituted of an aggregation of ochreous-white follicles. After a short conjoined course, the two channels separate, the sacculate uterus becomes the straight and thick-walled FREE OVIDUCT, while the SPERM DUCT becomes a slender tube, the VAS DEFERENS, and conveys the seminal fluid to the male organ, passing in its course beneath the right tentacular retractor, and being buried in the tissues of the body-wall for a short distance before joining the distal end of the EPIPHALLUS; the PENIS SHEATH is a stout, bluish-white, and somewhat muscular tube, opening into the common vestibule or ATRIUM, close to the external aperture, which is beneath the right OMMATOPHORE, and whose retractor muscle passes between and separates the male and female organs; the penis sheath is continued distally as an epiphallus, and extends beyond as a long and exceedingly slender FLAGELLUM, within the lumen of which the SPERMATOPHORE, a peculiar filament of characteristic shape, formed of agglutinated spermatozoa, is secreted, and which was apparently mistaken by Draparnaud for the love-dart; the SPERMATHECA is a red-brown glandular vesicle, fixed by its neck to the distal end of the OVISPERMATODUCT, and also complicated by the attachment of a muscle from the COLUMELLAR RETRACTOR; the vesicle is carried on a long stem which opens into the FREE OVIDUCT, and about midway gives off a long caecal diverticulum, which is fixed terminally at the base of the albumen gland, and within which is lodged the spermatophore received from the partner during congress. The paired MUCUS GLANDS or multifid vesicles are placed above the dart-sac or stylophore, and each is constituted on the average by about twenty-five tassel-like tubular glands.

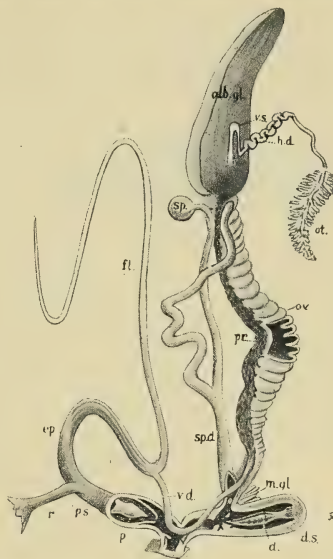


FIG. 310.—Reproductive organs of *Helix aspersa*, dissected out and isolated. The penis sheath, stylophore, uterus, atrium, and vagina opened up—the penis sheath to show the intromittent organ; the stylophore, the contained dart; and the uterus its sacculate structure.

alb. gl. albumen gland; d. dart in situ; d.s. dart sac or stylophore; ep. epiphallus; fl. flagellum; h.d. hermaphrodite duct; m. gl. mucus glands; ot. ovotestis or hermaphrodite gland; p. penis; p.s. penis sheath; pr. prostate or sperm duct; r. retractor muscle of penis sheath; sp. spermatheca; sp.d. spermatheca duct with thick caecal diverticulum; ov. uterine portion of oviduct; v.d. vas deferens; v.s. seminal vesicle or claw.



FIG. 311.—Spermatophore of *Helix aspersa*, with more highly enlarged sections, showing the structure of the anterior and posterior portions (modified after Moquin-Tandon).

The large pyriform muscular STYLOPHORE or dart-sac is immediately beneath the mucus glands, and opens into the vagina slightly above the vestibule; it is formed of two chief layers, a thick translucent greyish-white outer coat, composed of annular and longitudinal muscle-fibres and a thinner and more vascular inner layer; the less muscular distal end bears a small sub-conical tubercle, with some closely apposed longitudinal rods at its sides, which are points of attachment for the base of the gypsobelum or love-dart, whose point is directed towards the aperture.

The GYPSOBELUM or love-dart is eight to ten millimetres in length, and though soft and flexible when removed from the sac, hardens quickly on exposure; it has a calcareous, hollow, slightly-curved, and pointed stem, somewhat expanded at the base, which fits upon and is slightly attached to the distal tubercle at the base of the sac, and is strengthened by four projecting, longitudinal blades, placed at right angles to each other, with somewhat thickened and rounded though slightly twisted outer edges, which cause the dart to revolve slightly during protrusion;

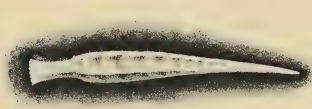


FIG. 312.



FIG. 313.



FIG. 314.

FIG. 312.—Gypsobelum or Love-Dart of *Helix aspersa*, $\times 4$, Christchurch, Hants.

FIG. 313.—An unusually ramose digitate mucus gland of *Helix aspersa*, bearing 46 branchlets, $\times 2$.

FIG. 314.—A very sparsely digitate mucus gland, with 14 branchlets only, $\times 2$.

the blades gradually diminish towards the point, but more abruptly basally, and are connected together at intervals by four to twelve crescentic and very thin calcareous films. The number of longitudinal blades is, however, not absolutely invariable, and specimens have been found possessing only two, the opposite pair having remained undeveloped.

The dart of this species belongs to a type whose characteristics are shared by only one other British species, *H. nemoralis*.

The ALIMENTARY SYSTEM is of the usual triodromous¹ character; the thin-walled ŒSOPHAGUS leads to the distensible elongate CROP, which is strongly ridged internally; the whitish SALIVARY GLANDS on its outer walls pour their secretion into the BUCCAL CAVITY by a pair of long and slender DUCTS; beyond the crop, the

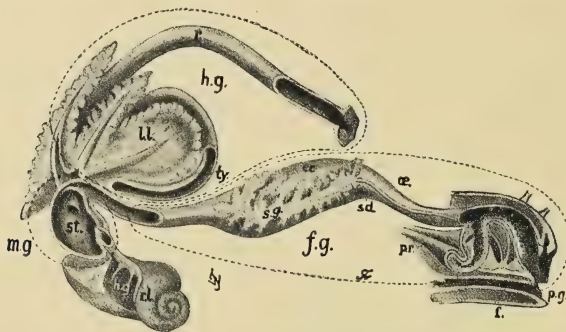


FIG. 315.—Alimentary canal of *Helix aspersa*, with appended glands, showing the regional division of its tracts (modified after Howes).

f.g. fore-gut or anterior region of the alimentary tract; *m.g.* mid-gut or stomachal region, and *h.g.* hind-gut or intestinal region; *b.c.* buccal cavity, showing radula, radula sac and jaw; *cr.* crop; *f.* foot; *h.g.* hermaphrodite gland or ovotestis; *l.l.* anterior lobe of liver; *æ.* œsophagus; *p.g.* pedal gland; *p.r.* pharyngeal or buccal retractor; *r.* rectum; *r.l.* posterior lobe of liver; *s.d.* salivary duct; *s.g.* salivary glands; *st.* stomach; *ty.* typhlosole.

alimentary tract contracts, but at the end of the ingestive tract abruptly enlarges, and forms a sacculate STOMACH, whose lining membrane is thrown into many longitudinal ridges, the ducts from the right and left lobes of the large and important DIGESTIVE GLANDS entering separately; on leaving the stomach the INTES-TINAL CANAL is directed forwards, and forms the first tract of its course, keeping to the left side of the body and within the tissues of the LIVER; on the termination of the first tract the canal is looped by and held in position by the anterior aorta; the second intestinal tract is directed towards the rear, and crosses to the right side of the body and becomes more dorsal in position; the final tract or RECTUM, which is again directed forwards, travels along the margin of the lung beneath the URETER and opens on the posterior side of the PULMONARY APERTURE.

The JAW measures two to three millimetres from side to side, strongly arcuate from front to back, somewhat crescentic in shape, with attenuate and rounded ends, thick, hard and dark-brown in colour; with six to twelve prominent vertical ribs or folds strongly denticulating both margins and showing perceptible longitudinal striation or lines of increase, with a few less prominent intermediate ribs, which may sometimes reach to and crenulate the lower or cutting margin.

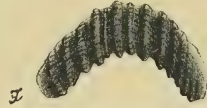


FIG. 316.—Jaw of *Helix aspersa*, × 8, from Christchurch, Hants.

The ODONTOPHORE or radula is of the usual oblong shape, and constituted by regularly curved transverse rows and straight longitudinal series of teeth, each transverse row composed of a symmetrical median tooth, with an elongate basal attachment; the mesocone being stout and conical, with a small lateral ectocone at each side; the laterals are decidedly asymmetrical, the inner angle of the basal attachment and the inner cutting point or endocone gradually becoming deficient, but the outer cutting point or ectocone is gradually more largely developed, and eventually as the marginals are approached, becomes very symmetrically bifid; the mesocone also gradually becomes bifid, so that the denticles near the margins present four strongly developed sub-equal denticulations with a narrow basal attachment.

The number of teeth on the membrane varies considerably in different individuals, possibly due in part to the age of the animal.

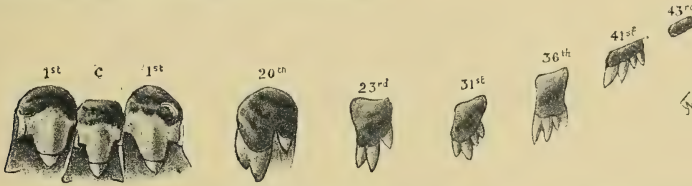


FIG. 317.—Representative teeth of half a transverse row of teeth of *Helix aspersa* Müll., collected by Dr. Scharff near Dublin (highly magnified).

The numerals appended to the figures of the teeth indicate their position in the transverse row.

The formula of the Dublin specimen was

$$\frac{2 \cdot 13 + 10}{4} + \frac{20}{2} + \frac{1}{3} + \frac{20}{2} + \frac{10 + 13}{4} \leq 145 = 12,615.$$

Reproduction and Development.—Though no fully detailed account of the conjugation of this species has been published, yet Mr. R. Standen and others have observed that the act is, as usual, preceded by many amatory caresses and blandishments, persistent fondling with their palpi, and the use of the love-dart, the tentacles meanwhile being bent downwards as though the animals were looking at each other; this peculiar attitude being only observable at these periods, may be owing to the diversion of the blood to other organs.¹ Though the dart is used apparently as an excitant of sexual desire, yet it is not an essential organ for that purpose, as pairings have been noted in young animals even before the formation of a dart has taken place.

The pairing takes place soon after their awakening from hibernation, which is seldom before April in this country, but in other countries this period will be modified in accordance with the climate and the rigours of the seasons; but the function is exercised throughout the summer months, as the sexual instinct is very strong and persistent, and in captivity can be excited almost at any time by a good meal and a thorough spraying with water.

According to Pascal, the actual congress sometimes occupies a period of ten to fifteen hours, the shape of the intromittent organ which, according to Mr. Butterell, has a movable apex, may be one of the reasons of this prolonged connection.

¹ Monog. i., p. 372, f. 688.

The eggs are laid very soon after conjugation, in holes excavated at the roots of herbage or at the foot of trees, and are covered with a little earth; they vary in number from about forty to one hundred or even more, and are clustered together and adherent by a sticky colourless mucus; they are roundly oval in shape, about $4\frac{1}{4}$ mill. long, and 4 mill. broad, with a tough whitish membranous envelope, but lack the firm cretaceous shell of the eggs of *H. pomatia*, although the membranous cuticle, which is composed of several concentric layers or films, is thickly bestrewn with crystals of carbonate of lime.

The eggs are hatched usually in from fifteen to thirty days, according to the weather; the young when excluded bearing a glossy, unbanded, reddish grey shell of one-and-a-half whorls. On beginning free life, they gradually acquire the characteristic black or dark coloured banding or maculation, and increase slowly in size, attaining before hibernation one-third or even one-half of their total growth. On emerging in spring, the animals are very voracious and hungry, and have been known to consume their own weight in food, and become so gorged as to be unable to withdraw within the shelter of their shell; growth, however, is then very rapid, and specimens have been known to add thirty millimetres of shell within the space of two weeks, and full growth is attained within twelve or fifteen months from the time of hatching, but no individual in this country attains maturity without passing through one period of hibernation.

Although the bulk of the individuals in this country probably die or are destroyed during their second hibernation, yet under favourable circumstances and in captivity they live to a much greater age, as Mr. R. Welch has kept specimens in confinement until they have attained to six, eight, and even ten years of age.

Habits and Habitats.—*Helix aspersa* being one of our most highly-developed and adaptable European species, is, like the white man, a great colonizer, and has by human or other agency been accidentally or purposely transported to almost every quarter of the globe, where its superior organization and adaptability have enabled it to maintain its foothold in new regions, and, like the European, to gradually dispossess the more feeble races which formerly occupied them.

Though very adaptable and inhabiting a considerable variety of situations, it is not a woodland species, but frequents comparatively open spaces, more especially affecting gardens, hedgerows, and cultivated land around dwelling houses, for which places it displays a marked preference and does considerable damage.

It is also very partial to old walls overgrown with ivy, or shaded with a growth of *Ceterach officinarum*, alders, nettles, weeds, etc., and in such places it is sometimes found in extraordinary numbers.

Though in this country it is not partial to a clayey soil, appearing to prefer a calcareous or sandy surface in the vicinity of the coast, yet it is by no means confined to such conditions, but lives and prospers under varied circumstances quite in the interior of the country.

H. aspersa is a very powerful animal and has a great reserve of strength, judging by the weights it can carry without diminution of speed. On level ground when in active motion, a moderate sized individual can travel one yard in twelve minutes, or at the rate of a mile in a little more than a fortnight; but its motions are sometimes much more deliberate, and no quicker than at the rate of a mile in nineteen weeks.

In addition to the weight of its shell, it can also without perceptible effort draw or bear on level ground a weight fifty times its own, or can ascend vertically carrying a burthen nine times the weight of the animal and shell combined, a feat equivalent to that of an ordinary man carrying a weight of about a ton.

The locomotory waves¹ or muscular contractions as seen on the foot-sole during progression are very noticeable, and I have invariably counted seven of these as being visible at one time, while the mucus-track left by its progress is, according to the observations of Mr. Lionel E. Adams, peculiar and strikingly characteristic, not constituted as might be supposed by a more or less continuous trail of slime, but by a series of mucus-patches at practically regular intervals.

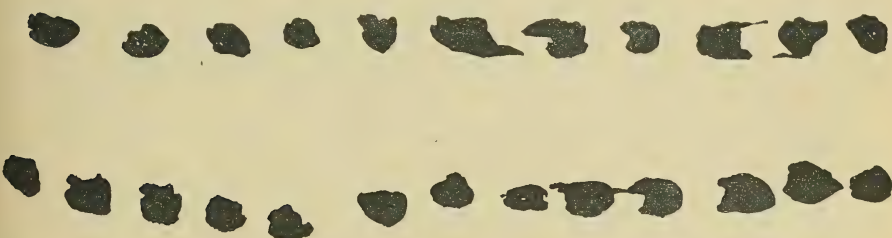


FIG. 318.—Facsimile of a line of slime-tracks of a *Helix aspersa* upon the outer wall of Oakhill House, Reigate, reduced to half natural size (after a nature sketch by L. E. Adams).

H. aspersa at ordinary times respire about four times per minute, and, according to Mr. C. Ashford's observations, with a pulse or heart-beat during siesta of about sixty-one times per minute, quickening to eighty-three contractions per minute when emerging from its shell, but the activity of these processes is very susceptible to modifications by heat or cold.

This species from its size and habit of living in close association with human habitations has shown that under certain circumstances, as when crawling over a thin sheet of glass or other suitable vibratory substance, it can produce audible musical sounds, resembling those of the Æolian harp and analogous to those resulting from drawing a moist finger over the edge of a wine glass.

Though the shell is a great protection against enemies and vicissitudes of climate, yet its vital connection with the animal inhabitant is not essential to the continuance of the life and vigour of the snail, as specimens have been known which have continued active and well although the organic connection with the shell has been completely severed.

It is rapidly disappearing from the "Black Country" of the midland counties, and is rare around the smoky manufacturing towns of the north of England; but whether this scarcity is due to the baleful influence of the smoky atmosphere and the consequent poisoning of the vegetation, or to the greater prevalence of thrushes and other birds preying upon them, has not been determined.

In the Pyrenees it ascends to a considerable height, and was regarded by Dr. Fischer as the characteristic species of the region between 3,000 and 4,000 feet above the sea; while Nevill records it as reaching 4,000 feet in the Alps of Menton.

¹ Monog. i., p. 192, f. 376.

HIBERNATION AND ÆSTIVATION.¹—*Helix aspersa* is a socially gregarious hibernant, and very sensitive to cold, sometimes beginning to congregate together as early as September, when clusters may occasionally be found at the roots of shrubs in hedgerows and elsewhere. Later, with the gradually increasing cold, the mouth of the shell is permanently closed with the usual epiphragm, and the animals take up their quarters for the winter, usually clustering together within holes in rocks or walls, or buried even to the depth of several inches in the soil in hedgerows or at the foot of walls or herbage. If the periods of frost be intense or long continued, the animals shrink further and further within their shells, constructing additional epiphragms, until sometimes there may be as many as six or even eight, one behind the other, becoming gradually thinner and more delicate as they are more internally placed.

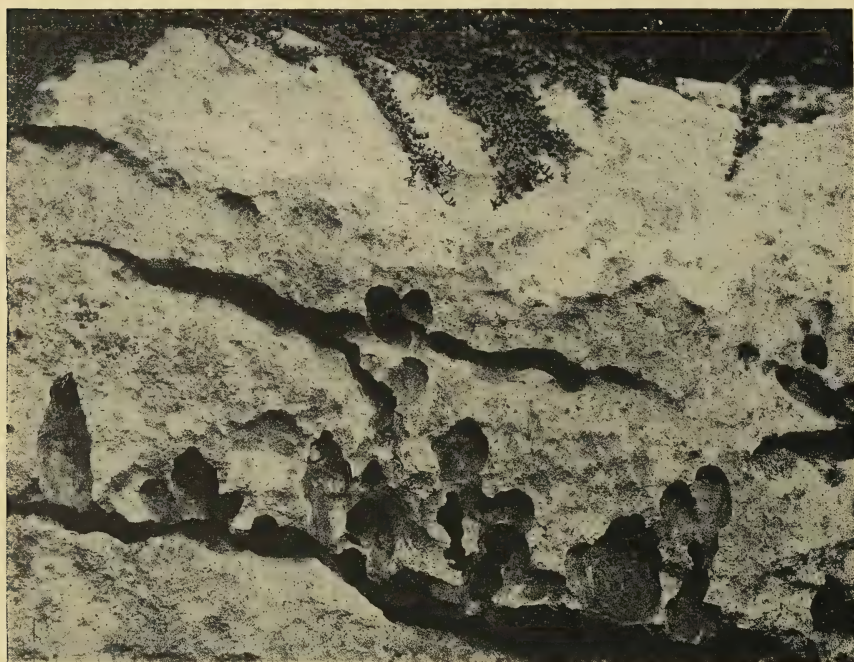


FIG. 319.—Helician cavities at Miller's Dale, Derbyshire, more fully exposed by the flaking away by frost of the face of the cliff (photographed by Mr. R. Welch).

When thus prepared against the winter's cold, they can withstand a considerable degree of frost without injury, as, according to Mr. E. J. Lowe, a specimen confined beneath a bell glass, upon a slate base, survived a temperature of 14° Fahr. or 18° of frost, a cold which destroyed specimens of *Arion ater*, *Limax flavus*, *Limax maximus*, *Agriolimax agrestis*, and *Milax sowerbii* confined in the same receptacle.

Immature specimens withstand the cold better than adults, retiring later and reappearing earlier. They also revive during the milder days of winter, and move about in mild evenings, perhaps retiring only during periods of actual frost, their more vigorous circulation probably accounting for their greater activity and hardihood.

¹ Monog. i., p. 308.

Though usually retiring to their habitual resort at the roots of trees, shrubs, or herbage, the sheltered base of walls or rocky hibernacula for their daily siesta, yet specimens are found not unfrequently affixed to the stems and leaves of shrubs or trees fully exposed to the sun's rays; but this is more frequently the case with immature shells than adults, which have more probably a regular place of mid-day resort.

In Australia, Mr. C. T. Musson has recorded this species as sheltering during æstivation in large numbers inside the cut hollow stems of the bamboo, reminiscent of those ancient shells found fossilized inside the Calamite stems of the Carboniferous strata of North America.

In addition to these casual places of shelter and rest, there are found in certain districts where the species abounds, innumerable vertical borings or perforations in the carboniferous limestone rocks, especially in those cliffs with a northern or north-eastern aspect, which have a very striking family likeness, and present similar features. *Helix aspersa* is credited with excavating these cavities in the rocks, which, in some districts are almost honeycombed by them, and though probably made and chiefly tenanted by *H. aspersa*, are occasionally occupied by other species not only for hibernation and æstivation, but as places of regular resort for rest and shelter.

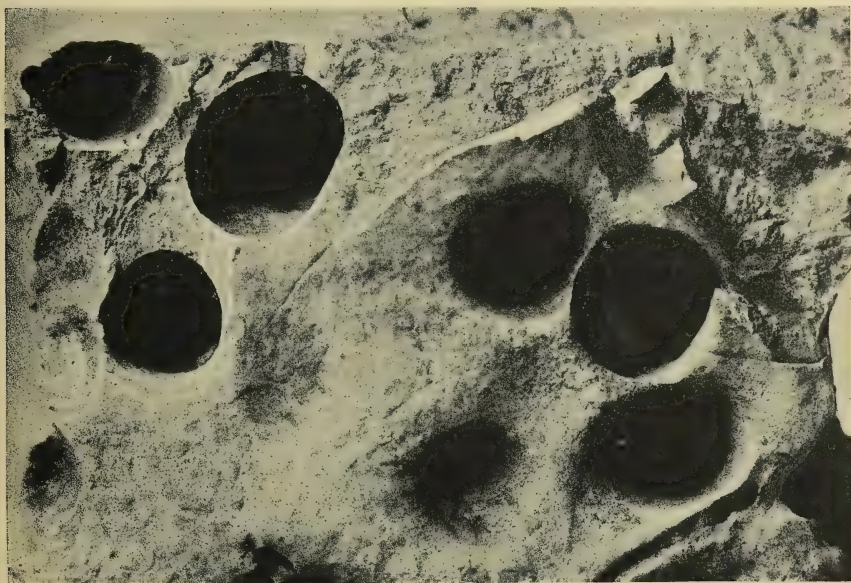


FIG. 320.—Helician Cavities or Hibernacula in the limestone of Great Orme's Head, Llandudno, as seen from beneath (slightly reduced, from photograph by Mr. R. Welch).

The ability of this species to excavate these rock dwellings in the course of ages can scarcely be questioned, as in addition to their demonstrated power to abrade limestone and chalk with their odontophores, M. Bouchard-Chantreaux, who studied these perforations at Bas Boulonnais, Boulogne, during many years, noting and measuring their gradual increase in depth, was convinced that *H. aspersa* was the author, especially as upon lifting the snails from the perforations, he found their mucoid secretion gave a distinctly acid reaction, perceptibly reddening litmus paper, and thus would tend to dissolve or disintegrate the rock.

At ten p.m. on the same day, five of the marked shells were absent, and two were traced to a small jungle of *Campanula pyramidalis* a short distance away; the others were evidently still further afield and could not be found, but on the following morning six of the marked shells were present, showing that four of those absent in the early evening of the previous night had again returned to the same resting place, and all were affixed within the line drawn around the group when first found, except one which was resting just outside the marked area.

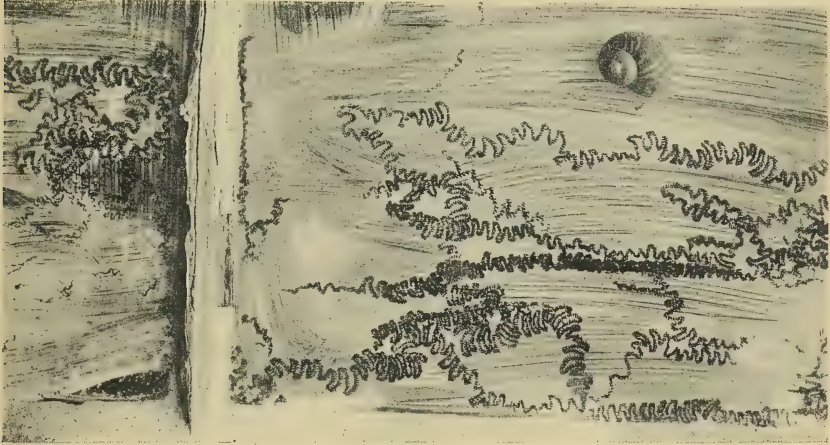


FIG. 321.—Feeding tracks of *Helix aspersa*, showing their general character, as seen upon the paste and whiting used in coating the glass roof of the greenhouse of the Rev. Dr. Norman, at Berkhamstead, one-fourth natural size (from photograph supplied by the Rev. Dr. Norman).

Whether the absentee had fallen a victim to an early thrush or other enemy or had lost its way was uncertain and could not be determined.

The striking results of this experiment would probably have been still more remarkable if the evening examinations had been made at a later hour, as in all probability the whole of the snails went out foraging every favourable night.



FIG. 322.—Feeding track of *Helix aspersa*, as shown upon the paste and whiting coating the glass of the greenhouse of the Rev. Dr. Norman at Berkhamstead, natural size (from photograph supplied by the Rev. Dr. Norman).

Food.—This species would appear to be fairly omnivorous, readily devouring many different kinds of food, and it is also probable that each species possesses some individuality in the track left by their browsing,¹

¹ Monog. i., p. 260, f. 520.

that of *H. aspersa* being an abruptly angled meandering series of more or less pyriform figures caused by the licking action of the radula, the angulation or reversal of direction being caused by the movement of its head from side to side.

In captivity, Dr. Gain found it to eat more or less readily 114 out of the 197 different kinds of food offered; many being cultivated edible plants or fruits, but though this large number was accepted as food, only lettuce was eagerly and greedily devoured.

Miss Hele, who has had great experience in rearing mollusks, found, however, that stale cabbage leaves which were beginning to turn orange-coloured in the progress of decay were decidedly preferred to all other food; lettuce leaves being next in order of preference.

Other observers have noted that this species is exceptionally fond of the leaves of nasturtium, hop, primrose, nettles, alder, wild celery, and wild cherry.

Mr. Hopkinson and others have remarked upon the attractiveness of the broom plant (*Sarothamnus scoparius*) as being very pronounced, this shrub in gardens being frequently covered with the snails which ascend its branches in the cool of the evening of even the hottest days.

M. Norguet has also recorded the marked preference shown for the laburnum (*Cytisus laburnum*) the foliage of which in the department of the Nord is greedily eaten to the neglect of that of all neighbouring shrubs.

Among the foods which the species will eat on occasion is the holly, the leaves and even the spines being consumed. Dr. Johnston records it feeding on the fiery-flavoured foliage of *Clematis flammula*; Mr. Standen on decaying seaweed by the shore at Portsalon, Donegal; it has also been noted feeding upon dead or dying earthworms; and has been known, according to M. Bonnafoux, to perforate birds' eggs to get at their contents.

They however, avoid mint, laurel and sweetbriar, and the mustard plant is held in special abhorrence.

They will eat voraciously the leaves of the spindle tree (*Euonymus europæus*), though this leads to their death in a very few days. The yew tree would also seem to have a baneful influence on this species. Messrs. Adams and Thompson have recorded that the sides of the "Pilgrims' Roads" or paths made by the processions of pilgrims to the shrine of Thomas à Becket, at Canterbury, are planted with yews, and under these trees heaps of dead shells of *H. aspersa* were so invariably found that it suggested the possibility that the yew poison, which affects cattle so injuriously, may also act on the snails.

Enemies and Parasites.—The enemies of *H. aspersa* include most of those preying upon mollusks generally, as rats, moles, and hedgehogs, which, under certain circumstances, devour the animal with avidity. The rabbit is, according to Mr. L. E. Adams, another of its enemies, as he found at Portrush an abundance of the gnawed and empty shells about the entrance to the burrows.

The Field Vole (*Microtus agrestis*) also destroys many of this species, Mr. E. W. Swanton finding abundant evidence of their destructiveness in a limestone quarry at Minshull, Dorset.

Ducks, geese, fowls, thrushes, blackbirds, etc., are all likewise very destructive and persistent enemies.

Coleoptera, however, also commit great havoc among molluscan life, *Drilus*, *Lampyris*, *Staphylinus*, *Silpha*, etc., either in the perfect or larval stages, preying upon and destroying them.

Many Diptera in their larval stages are especially inimical to mollusca, the *Phora maculata* Meigen being added by Mr. A. H. Pawson to the known parasites of this species.

Among the ecto-parasites, Semper mentions that the foot of nearly every individual is infested by the larvæ of certain Entozoa; while Garnault describes the liability to parasitic castration of this species by the ravages of the sporocysts of a Trematode.

Uses.—Although *Helix pomatia* is usually more esteemed as food than the present species, this predilection is not universal, as we have the authority of M. Jules Colbeau in stating that *Helix aspersa* is preferred by the Belgians.

In the south-west of England, especially about Bristol and Swindon, it is much sought after for food, under the name of "wall fish," and it furnishes a regular occupation to a number of persons to search out and collect this species, which is offered for sale in Bath and Bristol, and probably other places.

In France, they are also constantly offered for sale in the markets of Paris and other towns, and regularly supplied as part of a ship's provisions to trading and other vessels; while foreign seamen touching at our ports frequently make excursions inland to collect this species for food.

In Spain, where these and other land mollusks are regularly used as food, there is, as in Valencia, a special snail market, where the women, who are called "Caracolas," congregate in the open market square with heaped-up baskets of snails, loudly crying their wares, and occasionally cracking a shell with their teeth to show the quality.

As a healing plaster for wounds, slips of paper upon which *H. aspersa* had crawled, were thirty years ago, according to Mr. W. M. Webb, sold at one penny the piece in London, and when applied to the wound induced rapid healing.

Mr. D. Dyson, in his "Shells of Manchester," records that vast quantities of this species were formerly collected in Yorkshire from which to manufacture a greenish salve, which was exposed for sale on the stalls in Shudehill, Manchester, and was a very effective cure for corns.

Geological Distribution.—*Helix aspersa* was long unknown in the British Isles from any but the most superficial and quite modern deposits, but the exertions of Messrs. Lewis Abbott, Kennard, Woodward, Rev. R. A. Bullen, and other enthusiastic workers have extended and confirmed its backward range in time, and demonstrated that although until quite recently its claim even to pre-Roman age in this country was disputed, it is now so frequently found in the "kitchen-middens" of early Neolithic man that all doubts as to its antiquity have been set at rest.

Prof. R. Tate many years ago announced *H. aspersa* as one of our uppermost Tertiary fossils, the record being based upon a single specimen said to have been found in the Alluvial beds of the Kennet Valley, but Mr. B. B. Woodward from his investigations of the subject believes that the specimen was not obtained from the undisturbed deposit but from one of the numerous holes which are dug out to obtain peat and which afterwards speedily fill up.

PLEISTOCENE.—This species, not hitherto reliably known from British Pleistocene beds, has been obtained from the remarkable deposits in the Ightham fissures near Wrotham, West Kent, by Mr. W. J. Lewis Abbott, who remarks that although the known burrowing habits of the species must induce caution in claiming it as of truly Pleistocene age, yet the finding of about a dozen specimens here and there in the deposits, not only entire shells but many fragments of various sizes, tends to confirm the specimens as being genuine relics of that period.

In France, it is recorded by Comm. Caziot as common in all the deposits of Mid-Pleistocene age about Villefranche-sur-Mer, Alpes Maritimes; and a large form is recorded by Nevill, which abounded at a depth of five feet from the surface, immediately above the lower strata of the "Couche Marneuse" or zone of *Helix paveliana* at Cape Mortela, Mentone.

In Corsica, it is reported by Locard from bone breccia about Bastia, and from the grottoes of Grimaldi in the province of Porto Maurizio.

In Italy, it has been found by Valentini in the "Travertin" of Ascoli Piceno in the Marches; and Issel has also recorded it as existing within the layers of "Travertin" on the Islet of Galita, south of Sardinia.

In Sicily, according to Benoit, it has been found in "Tertiary" deposits at Brancaccio, Billiemi, and Altavilla near Palermo.

In Spain, it was recorded by Prof. Tate from the bone caves of Gibraltar.

In Algeria, it is recorded by Bourguignat, on the authority of Deshayes and others, from the limestone beds of the Island of Rachgown at the mouth of the river Tafna near Oran; from the limestone on the coast at Fouka near Koléa, Cherchell, Guyotville, and Ain-Taya near Algiers; also from rocks at the end of the Lamoricière fosse in the Algiers fortifications.

HOLOCENE.—In West Cornwall, Kennard and Warren record its occurrence in Neolithic "kitchen-middens" at Harlyn Bay; also in the blown-sand and associated deposits at Towan Head, Newquay; and Mr. J. P. Johnson has noted it at a depth of ten feet in a compact sandy deposit on a quarry at Gwithian Towans near Hayle, and has also found it in the neighbouring Riviere Towans; and Mr. Kennard reports it from buried land surfaces on the sandhills at Godrevy, Hayle, and Lelant.

In South Somerset, Mr. H. St. George Gray has recorded the frequent presence of *H. aspersa* in Wick Barrow (Pixies' Mound), Stoke Courcy or Stogursey, which was excavated in 1907, and attributed by him to the early Bronze age, or about 1800 B.C.

In Wilts., Mr. J. W. Flower has observed its constant presence in British barrows. In November, 1882, General Pitt-Rivers found three specimens about two feet below the surface associated with *H. pomatia*, during his excavation of a Romano-British dyke in Shiftway Coppice near Rushmore; in 1887, six specimens were found in the excavations at Rotherley, and in 1888, when excavating the Bokerly Dyke, Woodyates, an entrenchment in high relief nearly four miles long, of Romano-British age, which crosses the old Roman road from Sarum to Badbury, and forms the boundary between Dorset and Wilts., he found many shells of this species, associated with those of *H. nemoralis*, the oyster, and a few fragments of mussel shells. Mr. H. St. George Gray also found it abundantly in the superficial deposits in the fosse of the great circle at Avebury in the north of the county.

In Dorset, Mr. J. C. Mansel-Pleydell has occasionally found it in ancient interments; and in 1909, Mr. H. St. George Gray during his excavations

of the Roman Amphitheatre at Maumbury Rings, Dorchester, found many specimens which, though generally of typical form and markings, yet also yielded the vars. *conoidea*, *minor*, and *zonata*.

In the Isle of Wight, Mr. C. Ashford noted a layer of *H. aspersa* and other shells at a depth of twelve to twenty inches, disclosed by the cutting of a cliff-path between Orchard and Mount's Bay, Ventnor; and Mr. Kennard has detected it in a Neolithic rain-wash on St. Catherine's Down.

In East Sussex, Mr. W. J. Lewis Abbott records a quantity of very large specimens from beneath about three feet of "kitchen-midden" material in association with *Littorina littorea*, *Patella vulgata*, *Cardium echinatum*, *Buccinum undatum*, etc., at Hastings, all of which had probably been used as food. Mr. J. P. Johnson has found it in a Neolithic hill-wash at Brighton. In West Sussex, Mr. R. Miller Christy reports finding in 1878 "assuredly pre-Roman specimens in association with *Clausilia rolpheii*, *Cyclostoma elegans*, and *Helix nemoralis*, buried beneath the loose earth, filling up the pits within the Roman camp at Cissbury."

In East Kent, according to Kennard and Woodward, it is plentiful in Holocene deposits at Dover, one specimen being found on the horizon of Neolithic pottery; and Mr. Kennard reports it from a probably post-Roman hill-wash at Folkestone. In West Kent, it is recorded by Mr. A. S. Kennard from a pre-Roman deposit at Greenhithe; also from the base of a tumulus of early Romano-British age at Stanley's Quarry, Ightham, and mixed with bone fragments and Roman pottery from the base of a rain-wash, two feet to six feet thick, on the site of a large Roman building at Darent, excavated in 1894-5.

In Surrey, the Rev. R. Ashington Bullen found a specimen at nine inches and one at ten-and-a-half inches deep in a pre-Roman deposit in Horseshoe Pit, Colley Hill, Reigate; and Kennard and Warren report it from the alluvial marshy clay and carbonaceous silt disclosed by the excavations in Tooley street, Bermondsey.

In South Essex, Kennard and Woodward record it from the pre-Roman alluvial marl of the river Lea, exposed by the excavations for the new reservoirs of the East London Waterworks Co.; while Mr. J. French has found it in the alluvial shell-marl at Felstead; and Dr. Corner discovered it associated with a wooden pin and Neolithic flakes, about eight feet deep, in alluvium, at New Park near White House, Lea Marshes.

In Middlesex, Mr. A. Santer Kennard reports it from the bed of the Old Walbrook, amongst Roman remains at London Wall, and with those of the thirteenth century at Cloak lane; at America square it has been found in the Roman ditch, and at Houndsditch within the crevices of the old Roman wall.

In Berks., Dr. Gwyn Jeffreys recorded it from the peat bed at Newbury.

In Oxford, Kennard and Warren found an undoubted apical fragment of *H. aspersa* in a section through a Thames deposit, about a mile south-east of Culham station, Clifton-Hampden.

In Cambridge, Mrs. McKenny Hughes records it as plentiful in the Roman rubbish heaps at Chesterford and elsewhere about Cambridge, and occurring in such a manner as to preclude the possibility of its getting there subsequently.

In Glamorgan, Mr. J. Storrie records specimens being found during the excavation of the Roman villa at Llantwit Major near Cardiff.

In North Lincoln, it is reported by Mr. Kennard from within a Roman drain at Skegness.

In Cheshire, Mr. B. B. Woodward has recorded its presence in deposits resembling "kitchen-middens," formerly on the shores of the river Mersey, but now about a mile therefrom.

In Lancashire, it has been found by Mr. J. Wilfrid Jackson near the top of the "cave-earth" deposits in the Dog Holes, Warton Crag, Carnforth.

In Northumberland South, many shells of *Helix aspersa* were found in 1907 between two concrete floors in excavating the remains of the Roman city of Corstopitum (A. Meek, *Archæologia Æliana*, 1908, vol. iv., p. 99).

In Cheviotland, it was found in a bed of gravel on Holy Island in 1854 (Geo. Johnston, *Proc. Berw. Nat. Club*, 1874, vol. vii., p. 35).

In Ireland, it was found in West Galway by Mr. T. Rogers in alluvial deposit at Gorteen, and it is recorded by Collier and Standen from the earthy bed about one foot in thickness overlaid by a deposit of blown sand at Dog's Bay, Roundstone; in a lower zone of the same land shell deposit, Mr. R. Welch has remarked that the *H. aspersa* are large and heavy, and associated with the large and ponderous *H. nemoralis*.

In West Mayo, Mr. Welch found it in Sept. 1909 in the "kitchen-middens" on Clare Island, but these deposits, being very superficial, may have been disturbed, and the presence of *H. aspersa* as a genuine relic doubtful, especially as the species abounds in the vicinity in a living state, and none could be found in the land-shell deposit beneath the "middens."

In Clare, Miss Parkinson found the species abundant in July 1905 and Nov. 1907, in the deposits of Drumcliff Crannoge, Ballyalia Lake, near Ennis.

In France, according to M. Fagot, it is found in many of the quaternary deposits about Villefranche, Haute Garonne.

In Algeria, Bourguignat, on the authority of Deshayes, reports it from the recent sands of Doneira near Algiers, and from the sandy deposits of Cape Férat near Bône.

In Tunis, in the "travertin" beds of the Isle of Galité, Dr. Issel found specimens very close to the Sicilian *Helix mazzullii*.

Variation.—The variation of this species is chiefly in the character of its colour and markings; the differences in the shape of the shell, though striking in the extreme forms, is yet not really great, but the colour variation, which varies from a primrose-yellow with or without darker bands or markings to an almost uniform black, produces some very pretty combinations.

The markings are usually displayed as more or less distinct revolving bands of a darker shade, but the spiral character of the fasciation may become totally obscured by the diffusion of the dark pigment and the pale ground tint be only shown amidst a multitude of flamboyant markings which, in other examples, tend to join or fuse together and form irregular transverse bandings.

In form of shell, there is a pronounced tendency for the obliquely globose form to predominate in the more northerly part of its range, but in the southern regions, as in Southern France, Spain, Portugal, etc., the species is more inclined to be acuminate and to approximate in form and in transverse sculpture with the Sicilian *Helix mazzullii*, a probably earlier offshoot from the same stemma.

The ground colouring is said to be greatly affected by the nature of the food, lettuce apparently darkening the shells; Mr. J. Hawkins, of York, has also recorded that specimens fed on burdock (*Arctium minus*) are much paler in colour than those living upon cow parsley (*Heracleum sphondylium*), while individuals fed upon ivy (*Hedera helix*) become of a bright red colour.

The var. *exalbida* is the nearest approach to albinism in this species; but as in the mollusca generally, albinism is usually only partial; thus though the shell may be albino, the animal inhabitant is generally normally pigmented; but examples the reverse of this have been found at Northampton by Mr. L. E. Adams and by Mr. Lewis Abbott in St. Margaret's road, St. Leonards-on-Sea, in which although the animals were albino, with pale pink eye specks, the shells were quite normal in size and coloration.

Total albinism shared alike by the animal and its shell is quite rare, but Mr. W. Gyngell in July 1909 discovered a colony on the sandhills of Seaton Carew, in which the var. *exalbida* constituted seventy-five per cent. of the whole colony, though only ten per cent. of these were true albinos, in which the animal inhabitant and the shell were equally affected.

As has been frequently pointed out, this species is exceedingly susceptible to and responsive to its varying environments; the shells of any definite area being characterized by a different facies from those inhabiting a neighbouring district which may be of a different character, and, further, the geological features of the country impress their mark on the shells of this species, and this may be indicated not only in the varying colour and markings of the shell, but in its texture and consistency.

Though usually this species, like others, secretes the thickest and heaviest shells when living on limestone soils, and produces thin and delicate ones when there is a deficiency of that substance, as in the Channel Isles and especially in Guernsey, where owing to the scarcity of calcic material the shells are remarkably thin, such effects may also be due solely to the impaired or abnormal selective action of the tissues of the individual, as thin and delicate shells may be found in places where ample calcic material is available; whereas, on the contrary, on the millstone grit about Caton, near Lancaster, Mr. J. Davy Dean has found some unusually thick and heavy shells, one weighing more than 129 grains. This remarkable instance may be paralleled by *Unio margaritifera*, which uniformly produces a ponderous shell, although living in water almost deficient of calcic carbonate.

Proximity to the sea usually, though not invariably, has the effect of dwarfing the shell, and always bleaches it, until it becomes as white and chalky as in the progress of decay.

VARIATIONS IN SHAPE OF SHELL.

Var. **conoidea** Picard, Moll. Somme, 1840, p. 181.

Helix aspersa var. *conica* Gassies, Moll. Agenais, 1849, p. 82.

Helix aspersa var. *acuminata* Baudon, Journ. de Conch., 1884, p. 238.

SHELL thin and fragile, with a very produced conical spire, and small aperture.

The sub-var. **acuminata** is described as oblong, very conical and rather narrow.

ENGLAND AND WALES.

Channel Isles—A wall on damp ground near Arnold's Pond in North Guernsey! Rev. Dr. McMurtrie. Messrs. Tomlin and Marquand record this variety from Moulin Huet, Guernsey; Braye Bay and Mauney, Alderney.

Cornwall W.—Newquay! J. H. James.

Devon N.—Ilfracombe, G. Sherriff Tye. Hele Bay, J. E. Cooper.

Somerset N.—Bratton St. Maur, not common, E. W. Swanton. Rev. Dr. Norman reports an elongate variety from Clevedon as var. *producta*.

Isle of Wight—Ventnor, A. Loydell. Carisbrooke Castle ! F. Booth.

Sussex W.—Tolerably common on a stone wall facing the sea at Littlehampton, 1883, W. C. Atkinson. Worthing ! J. H. James.

Sussex E.—Lewes, J. H. A. Jenner. Downs, Eastbourne, Rev. S. S. Pearce.

Kent E.—Folkestone ! Mrs. Fitzgerald. Faversham, July 1883, Miss Fairbrass. Kingsdown, J. E. Cooper.

Surrey—Caterham Junction, Sept. 1884, T. D. A. Cockerell.

Berks.—Maidenhead, July 1880, L. E. Adams.

Oxford—Near Oxford, Mrs. M. E. Cusack.

Bucks.—In garden, Aston Clinton, 1900, A. Leicester.

Suffolk E.—Blythburg, J. E. Cooper.

Norfolk E.—Near Hellesdon, A. Mayfield. Yelverton, Rev. S. Spencer Pearce.

Cambridge—A very small, conical specimen, 17 mill. in diameter and 20 mill. in altitude, found in garden at Cambridge (H. Watson).

Northampton—Grimscote, 1884 ! A. Loydell.

Gloucester E.—Gloucester, Sept. 1883, J. Madison.

Gloucester W.—In hedges about Bristol, 1874, Miss F. M. Hele.

Glamorgan—Cogan near Cardiff ! F. W. Wotton.

Pembroke—Plentiful, Castle Hill, Tenby, G. Sherriff Tye. Common at Tenby, on Marsh road, and Castle Hill, also found on the South Cliff, 1895 ! A. G. Stubbs.

Cardigan—Aberystwyth, May 1888 ! E. Collier.

Merioneth—Barmouth, Aug. 1886, Lionel E. Adams.

Denbigh—Llandudno, 1884, E. Collier.

Anglesey—Beaumaris, G. W. Adams.

Lincoln N.—Sandhills, Mablethorpe, 1900, C. S. Carter. Little Cotes, Sept. 1902, A. Smith.

York S.E.—Bridlington, 1881, Rev. W. C. Hey.

York N.E.—Castle Hill, Scarborough, J. A. Hargreaves. Filey ! J. E. Crowther.

York Mid W.—Ingleton, Aug. 1888 ! E. Collier.

York S.W.—Pontefract, G. Roberts. Sandal Castle Hill, 1883, J. Wilcock.

Cumberland—Whitehaven, Sept. 1883 ! R. D. Darbshire.

Isle of Man—Douglas road, Peel, and Pool Vaish, Aug. 1891, Wm. Moss and R. Cairns.

SCOTLAND.

Cantire—Plentiful about the old castle, Tarbert, T. Scott.

Edinburgh—Inchkeith, T. Scott.

IRELAND.

Dublin—A most curious elongated variety from near Killiney Castle (W. W. Walpole, Zool., 1853, p. 4022).

CONTINENTAL DISTRIBUTION.

France—Common about Paris according to Pascal ; also cited by de l'Hôpital from walls and in disused quarries about Caen in Calvados ; Fagot records it from Mont Alarie, Aude ; and it was collected by Mr. S. C. Cockerell in Aug. 1885 at Veules-en-Caux, Seine Inférieure ! The sub-var. *acuminata* is recorded by Baudon from the quarries of St. Laurent, Mouy, Oise ; and the sub-var. *conica* enumerated for the Agenais by Gassies. Mr. F. H. Sikes in Sep. 1907 found a closely-allied form on the Chauney Isle, department of the Manche !

Italy—Recorded by Prof. Issel from the environs of Terni, Umbria ; by Paulucci from Calabria, at Palmi, and a small variety at Monteleone. In Sicily, this variety is figured by Dr. Tiberi as the typical Sicilian form ; it was collected in Aug. 1904 by Mr. L. E. Adams about the ruined temples of Girgenti ; it is also recorded from Sardinia at Monte Santo di Pula by Paulucci ; and is said to be found on the Islands of Malta and Gozo.

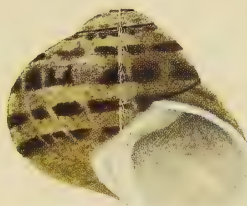
Spain—Collected at Alicante in province of Valencia by Mr. R. D. Darbshire.

Algeria—Recorded from the environs of Constantine by Bourguignat, from which place I have seen specimens from the collection of Mr. J. H. Ponsoby. Lallemand records this variety from Flicet-el-Bhâr and Beni-Djenad, Kabylia.

Tunis—Ain-Draham and Fedj-Saha, Letourneaux and Bourguignat.

New Zealand—Auckland, C. T. Musson.

HELIX ASPERSA Müller.



Helix aspersa Müller.

Stroud, Gloucestershire, E. J. Elliott.

(For figures of var. *flammea* and sub-vars. *albofasciata* and *zonata*, see Frontispiece of Vol. I.).



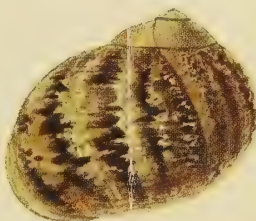
Helix aspersa var. *conoidea* Picard.
Constantine, Algeria.



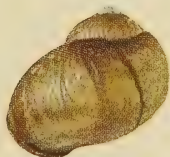
Helix aspersa sub-var. *puncticulata* Baudon.
Llandaff, Glam., F. W. Wotton.



Helix aspersa var. *depressa* Paulucci.
Castletown, Isle of Man



Helix aspersa sub-var. *undulata* Moq.
Bristol, Miss Hele.

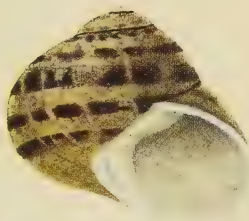


Helix aspersa sub-var. *tenuis* Jeffr.,
Moulin Huet, Guernsey, Rev. Dr. McMurtrie.



Helix aspersa sub-var. *lutescens* Cockerell,
Hutton Bushel, Yorks., W. Gyngell.

HELIX ASPERSA Müller.



Helix aspersa Müller.
Stroud, Gloucestershire, E. J. Elliott.

(For figures of var. *flammea* and sub-vars. *albofasciata* and *zonata*, see Frontispiece of Vol. I.).



Helix aspersa var. *conoidea* Picard.
Constantine, Algeria.



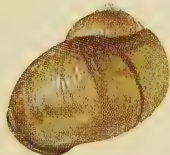
Helix aspersa sub-var. *puncticulata* Baudon.
Llandaff, Glam., F. W. Wotton.



Helix aspersa var. *depressa* Paulucci.
Castletown, Isle of Man



Helix aspersa sub-var. *undulata* Moq.
Bristol, Miss Hele.



Helix aspersa sub-var. *tenuis* Jeffr.,
Moulin Huet, Guernsey, Rev. Dr. McMurtrie.



Helix aspersa sub-var. *lutescens* Cockerell,
Hutton Bushel, Yorks., W. Gyngell.

Var. **globosa** Picard, Moll. Somme, 1840, p. 181.

Helix aspersa var. *megalostoma* Bourg., Mal. Alger., 1864, vol. i., p. 103, pl. 8, f. 6.

Helix aspersa var. *depressa* Paulucci, Faun. Mal. Calabria, 1880, p. 120.

Helix (Pomatia) aspersa sub-var. *alticola* Nevill, P.Z.S., 1880, p. 113.

Helix aspersa var. *globulosa* Baudon, Journ. de Conch., 1884, p. 238.

SHELL more globose.

The var. **globosa** Pic., s.s., is described as "generally larger and more globose," and as partial to hedges and orchards.

The sub-var. **globulosa** Baudon is depressed and broad, the term "*depressa*" being said by its author to express its shape.

The sub-var. **megalostoma** Bourg. has a short, low spire, an excessively dilated last whorl, and a very ample aperture. The var. *macrostoma* Bourg. of H. Rolle's price list for 1903 is probably a misprint for *megalostoma*.

The sub-var. **depressa** Paulucci has a solid shell, with thickened lip, and resembles *H. aperta* in form.

The sub-var. **alticola** is described as 46½ mill. in diam. and 43 mill. in height.

ENGLAND AND WALES.

Somerset N.—Hedge-bank by Pitcombe Rectory, E. W. Swanton.

Sussex E.—Lewes, J. H. A. Jenner.

Kent E.—Mrs. Fitzgerald finds on the high chalk hills near the sea at Folkestone a large form with small depressed spire and ample mouth.

Berks.—Maidenhead, July 1880, L. E. Adams.

Suffolk E.—Small specimens off flint walls, Southwold, Sep. 1885 R. D. Darbishire.

Pembroke—Tenby, not uncommon on the Burrows near Black Rock; in the Jubilee Gardens and the Wreck Field, A. G. Stubbs.

Lincoln N.—Sandhills, Sutton-on-Sea, 1900, C. S. Carter.

York Mid W.—Collingham, 1889 ! F. Rhodes.

Isle of Man—Pool Vaash and Douglas road, Peel, Aug. 1892 ! W. Moss and R. Cairns. Point Scarlet, Aug. 1894, R. Cairns.

Cantire—Sub-var. *depressa*, Tarbert, rare, Thomas Scott.

SCOTLAND.

CONTINENTAL DISTRIBUTION.

France—Pascal records the var. *globosa* as common about Paris; and de l'Hôpital cites it for Calvados. As var. *globulosa* it is enumerated by Dr. Baudon for the Oise. As var. *depressa* Gassies reports it from the Agenais. As sub-var. *alticola* is recorded from the Alpes Maritimes on the alpine summits about Menton, and in a smaller form from near the surface of the "Couche Marneuse," at Cape Mortela.

Italy—Marchesa Paulucci gives var. *depressa* from Palmi, Calabria; and Signor Calcara describes varieties from Sicily as "*spira depressa*" and "*anf. ventricosis*."

Portugal—Specimens in the British Museum ! labelled "*Helix aspersa*, Oporto."

Algeria—M. Bourguignat records that the var. *globosa* is found here and there throughout Algeria; and the sub-var. *megalostoma* as found on Ile Maudite, between Cherchell and Oran; while Lallemant cites the vicinity of Algiers.

South Africa—Mr. J. S. Gibbons has collected this variety about Cape Town !

VARIATIONS IN SIZE OF SHELL.

Var. **major** Pascal, Moll. Haute Loire, etc., 1873, p. 35.

Helix aspersa var. *major* Baudon, Journ. de Conch., 1884, p. 238.

Helix aspersa var. *maxima* Parfitt, Trans. Devon. Assoc., 1874, p. 634.

Helix aspersa var. *maxima* Taylor, Journ. of Conch., iv., July 1883, p. 90.

SHELL larger than type.

The var. **major** Pascal, s.s., is 40 mill. in diameter, and 25 mill. altitude. Dr. Baudon gives the size of var. *major* as 40 mill. diam. and 37 mill. altitude.

The sub-var. **maxima** Parfitt is described as larger, thicker, and more conical, the second whorl more prominently inflated than in the type, epidermis yellowish and thin. When denuded, this variety shows a broad white band around the periphery, which renders the specimens very conspicuous. The lip is ferruginous brown.

The sub-var. **maxima** Taylor has a major diameter of 48 mill., a minimum one of 32 mill. and an altitude of 38 mill.



FIG. 323.—*H. aspersa* sub-var. *maxima* Taylor (Algiers, North Africa).

ENGLAND AND WALES.

Cornwall W.—Truro, 1885 ! J. H. James.

Devon N.—Sub-var. *maxima* Parfitt abounds on the sandhills at Branton Burrows near Bideford.

Somerset N.—Var. *major*, specimens in the British Museum from Blagdon and Weston-super-Mare, and Mr. Swanton has found in hedges about Bratton St. Maur "shells quite as large as *H. pomatia*," and approaching var. *nigrescens* in coloring.

Middlesex—A specimen of the var. *major* from the neighbourhood of London, kindly given me by Mr. Howard Vaughan, is 40 mill. in diameter !

Glamorgan—Llandaff, E. Collier.

York N.E.—Very large specimens are found at Pickering, according to the late Rev. W. C. Hey.

CONTINENTAL DISTRIBUTION.

France—The var. *major* is reported by Pascal as common about Paris ; and Dupuy records specimens from Preste, Pyrénées Orientales, "as large as the largest Algerian shells" ; while Nevill reports gigantic tumid forms from an altitude of 3,000 to 4,000 feet on the mountains near Menton, Alpes Maritimes.

Spain—Dupuy has recorded that he possessed shells from South Spain larger than the largest *H. pomatia*. Valencia ! R. D. Darbishire.

Balkan Peninsula—Var. *major*, a Dalmatian specimen obtained from Verkrutzen measures 40 mill. in diameter.

Sicily—Calcara cites a var. "*magna*" as found in Sicily.

Greece—Mrs. Fitzgerald has reported that the largest shells in her collection were collected in Greece.

Palestine—Canon Tristram records specimens "quite equalling those of Algeria" from gardens about Tyre, Sidon, Beyrout, Jaffa, and other places on the coast.

Algeria—Var. *major*, specimens of this variety in the British Museum from Constantine. M. Lallemand also records the variety from Kabylia, remarking that they are larger, darker, and more shagreened than the specimens from Algiers, which vary little in colour or form. Algerian specimens procured from Verkrutzen constitute the types of sub-var. *maxima* Taylor.

Tunis—Magnificent shells are recorded by Letourneaux and Bourguignat from the Valley of Medjerda.

Var. *minor* Picard, Moll. Somme, 1840, p. 180.

Helix (Pomatia) aspersa var. *nana* Nevill, Proc. Zool. Soc., 1880, p. 113.

SHELL smaller than the type.

This variety was first figured by Férussac, but several authors have independently defined a var. *minor* ; that of Picard is described as not exceeding 20 mill. in diameter or height ; Dr. Bandon gives 25 mill. altitude and about 23 mill. diam. ; Marchesa Paulucci 26 mill. altitude and 25-28 mill. diameter ; Bourguignat says altitude 25-30 mill. and diameter 25 mill. ; Westerlund, 25 mill. diameter and 27 mill. altitude ; and Nevill a diameter of 28 mill. and an altitude of 22 mill.

The sub-var. *nana* is described as 25 mill. in diameter and 21½ mill. high.

M. Picard, who first described the var. *minor*, hazarded the conjecture that they might be really immature shells which had prematurely formed and completed the lip.

Bandon remarks that his var. *minor* resembles the var. *maritima* of Bouchard-Chartereaux from Boulogne-sur-Mer.

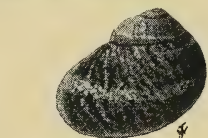


FIG. 324.—*Helix aspersa* var. *minor* Picard (Cardiff).

ENGLAND AND WALES.

Channel Isles—In Guernsey it is rather common and of typical texture in the north of the island ; one specimen found at Petit Pot Bay is only 21 mill. in altitude and diameter, J. R. le B. Tomlin. Rev. Dr. McMurtrie found it in Aug. 1885 near Arnold's Pond, North Guernsey, and at Icart in the south of the island. Messrs. Tomlin and Marquand also report it from Herm ! and cite one from Clanque, Alderney, only 19 mill. in diameter.

Cornwall W.—Tresco and St. Martin's, Scilly Isles, Aug. 1903, F. H. Sikes. Newquay ! J. H. James.

Devon N.—Hele Bay near Ilfracombe, J. E. Cooper.

Devon S.—Torquay, B. M. Oakeshott.

Somerset N.—Frequent, Bratton St. Maur, E. W. Swanton.

Dorset—Weymouth and Wareham, Charles Ashford.

Hants. S.—Mudeford, on the cliffs, and one at Christchurch only 22 mill. in diameter, Charles Ashford.

Sussex W.—Amongst ivy at Brighton, Apl. 1878 ! R. M. Christy. Worthing ! B. M. Oakeshott.

Essex N.—Roadside hedge, Chelmsford ! R. Miller Christy.

Suffolk E.—On flint walls, Southwold, Sep. 1885 ! R. D. Darbishire. Wickham Market, June 1887 ! Rev. S. Spencer Pearce.

Norfolk E.—Cromer, Aug. 1885 ! Rev. Dr. McMurtrie. Frequent, Yelverton, Alington, Trowse, and Old Lakenham churchyard, Rev. S. Spencer Pearce. Upper Hellesden and Heigham, A. Mayfield. Felixstowe, 19 mill. in altitude and breadth, Dec. 1904, F. H. Sikes.

Norfolk W.—Common at Hunstanton, Oct. 1894 ! T. Petch.

Gloucester W.—Bristol ! Miss F. M. Hele.

Monmouth—Walls of Tintern Abbey, Aug. 1886, J. Madison.

Worcester—Salford Priors, Aug. 1882 ! J. Madison.

Glamorgan—Llantwit Major, June 1886 ! F. W. Wotton.

Pembroke—Common in gardens overlooking south cliff, Tenby, Aug. 1898 ! A. G. Stubbs. Penally, H. Rowland Wakefield.

Cardigan—Aberystwyth, May 1888 ! E. Collier.

Denbigh—Eglwys Rhos, Llandudno, July 1877 ! W. Denison Roebuck.

Lincoln N.—Chalk banks, South Ferriby, March 1896 ! and near Louth, Sept. 1887 ! H. W. Kew. Mablethorpe sandhills, 1900, C. S. Carter. Little Cotes, Sept. 1902, A. Smith.

York S.E.—Riccall, Aug. 1875 ! Pontefract, 1885, Geo. Roberts. Spurn Point and Filey, Tom Petch. Gardens, Hull ; Kelsey Hill ; Bridlington ; road to Bessingley, A. J. Moore.

York N.E.—Coatham sandhills ! B. Hudson. Ingleby Greenhow, Rev. J. Hawell.

Cumberland—Carlisle ! Miss F. M. Hele.

CONTINENTAL DISTRIBUTION.

France—Recorded from Rochefort-sur-Mer, Charente Inférieure, by Regelsperger ; from Bordeaux, Gironde, by Dr. Scharff ; from gardens, Mouy, Oise, by Dr. Baudon ; from Preste, Pyrénées Orientales, and from the seashore, Boulogne, Pas-de-Calais, by Abbe Dupuy ; from the dunes around Boulogne, according to M. Bouchard-Chantereaux, where a very pretty variety is found, smaller in size than the ordinary *Helix hortensis* ; from Dieppe, Seine Inférieure, by Germain ; from Lagny, Seine-et-Marne, by Locard ; from the environs of Paris by Pascal ; and by Caziot from the Yonne. As var. *nana* it is recorded by Nevill from the sunny hill of Grimaldi, Alpes Maritimes.

Italy—Palmi and Nicotera, Calabria (Paulucci, Moll. Calabria, 1880, p. 120). Sicily ! J. Platania-Platania, 1880.

Spain—Sparingly on the higher parts of the rock of Gibraltar, K. H. Jones.

Algeria—About Algiers (Lallemant, 1868). On the rocks about Constantine and Medjoz-Amor (Bourguignat, 1864). Cirta, A. Morelet.

VARIATIONS OF SUBSTANCE OF SHELL.

Var. solidissima Paulucci, Faun. Moll. Calabria, 1880, p. 119.

Helix aspersa var. *solida* Westerlund, Faun. Moll. Extram., 1878, p. 133.

Helix aspersa var. *eburnea* Baudon, Journ. de Conch., 1884, p. 239.

Helix aspersa var. *ponderosa* W. A. Gain in litt.

SHELL much thicker and heavier than the type.

The sub-var. *eburnea* is described as of exceptional weight and thickness, and in the original locality as almost denuded of epidermis ; peristome thick, solid, and rather glossy, with a yellowish tinge, recalling the aspect of old ivory.

It has been frequently remarked that this species tends to produce a thicker shell than usual when living near the seashore.

Dr. W. A. Gain sent out shells about fifteen years ago under the name of var. **ponderosa**, which averaged about 35 mill. in diameter and 90 grains in weight.

ENGLAND AND WALES.

Dorset—One specimen collected in Aug. 1890 on the Purbeck limestone, Swanage, weighed 81 grains, C. Ashford.

Sussex W.—A dull coloured and extremely thick shelled variety living on the South Downs in rabbit burrows, R. M. Christy.

Glamorgan—Sub-var. *ponderosa*, Graig Tach, July 1894 ! W. A. Gain.

Pembroke—Several on the cliffs, by the sea, near Tenby, weighing 100 grains ! C. Jefferys, July 1896.

Lancashire Mid—Very solid shells, one weighing 129 grains, on the millstone grit at Caton, near Lancaster, May 1903 ! J. Davy Dean.

CONTINENTAL DISTRIBUTION.

France—Sub-var. *eburnea* in the quarries of the department of the Oise. This form is only found in hilly districts and on calcareous soils; it adheres to the rocks exposed to the sun (Baudon, l.c.).

Italy—Var. *solidissima*, Rocca Angitola, Calabria (Paulucci, l.c.).

Var. tenuior Shuttl., Moll. Corse, 1843, p. 17.

Helix aspersa var. *tenuis* Jeffreys, Brit. Conch., 1862, p. 182.

Helix aspersa var. *D. translucens* Gassies, Moll. Aquit., 1867, p. 122.

SHELL half the usual size, uniformly rufous in colour; very thin and transparent.

The sub-var. *tenuis* is described as dwarfed, extremely thin, and nearly transparent; bands reddish-brown.

ENGLAND.

Channel Isles—In Guernsey, it may be found in almost any sheltered nook and crevice on the south and south-west coast, J. R. le B. Tomlin. At Moulin Huet Bay, fine, very thin, and beautifully marked shells are abundant in the open, amongst furze, Rev. Dr. McMurtrie. Cobo Bay, Rev. W. C. Hey.

In Jersey, it was found plentifully in 1874 at St. Aubyn's Bay by Mr. H. Bendall.

In Herm, very delicate shells are found plentifully near the landing-place, where there is no drifted shell-sand.

In Sark, it is very common at La Coupée and elsewhere on the island, but somewhat variable in tenuity.

Cornwall W.—Sub-var. *tenuis*, sandhills near the coast; the specimens are remarkably thin, nearly transparent, and banded, E. D. Marquand. Whitesand Bay, J. E. Cooper.

Somerset N.—Rare, Bratton St. Maur, E. W. Swanton.

Dorset—Weymouth, Aug. 1867 ! one specimen weighing only three grains, Charles Ashford.

Isle of Wight—A beautifully delicate specimen at Ventnor, A. Loydell.

Sussex W.—Worthing, A. Loydell.

Worcester—Enumerated for Malvern by Griffiths in 1870.

Warwick—Kenilworth, J. Madison.

Norfolk—Yelverton, A. Mayfield.

York N.E.—Sub-var. *tenuis*, York, common (R. M. Christy, Zool., 1881, p. 246).

Westmorland and Lake Lancs.—Lower Lindale road, Grange, H. Beeston.

Cumberland—Harraby, Miss Jessie Hele.

IRELAND.

Antrim—Rathlin Island, Lionel E. Adams.

Galway W.—A colony of very large specimens embracing, amongst others, formulæ 10005 and 10040, in a field near Roundstone, A. W. Stelfox.

CONTINENTAL DISTRIBUTION.

France—Dr. Baudon records an exceedingly thin form, of a rufous colour, with reddish bands [sub-var. *tenuis*] from the wood at Hermes, Oise. Pascal reports it as common in the environs of Paris; Romagnoli from Bastia, Corsica; and Gassies cites the sub-var. *translucens* from the Agenais.

Spain—Staff-Surgeon K. H. Jones found at Arosa Bay, Galicia, large and richly coloured specimens and of such exceeding tenuity as to be almost membranaceous, reminding one of *H. fusca*.

Italy—Staff-Surgeon K. H. Jones collected some very frail specimens at Aranci Bay, Sardinia.

South Africa—Rev. J. W. Horsley reports a small thin form from the Cape.

Argentina—Strobel records very thin shells from La Plata.

New South Wales—In this state, about Sydney and other places, the var. *tenuior* is the prevailing form, the shells being small, very thin, and transparent, of a reddish tint, and often bandless, C. T. Musson.

New Zealand—Apua, Bay of Islands, C. T. Musson.

VARIATIONS IN SCULPTURE OF SHELL.

Var. rugulosa Bourguignat, Mal. Alger., 1864, i., p. 103.

SHELL much malleated and strongly shagreened.

Sicily—Signor Calcareo cites a var. "*striata*" as an inhabitant of Sicily, which may be referable to this form.

Algiers—Constantine, The Calle (Bourguignat, l.c.). M. Lallemand cites the Algerian coast as the habitat of this variety.

Var. **glabra** Calcara, Molluschi Sicilia, 1845.

SHELL smooth, with the usual rugulose sculpture almost obliterated.

Sicily—(Calcara, op. cit.).

VARIATIONS IN COLOUR OF SHELL.

Var. **exalbida** Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 175.

Helix adspersa var. *exalbida* Menke, Syn. Moll., 1830, p. 16 (*sine desc.*).

Helix aspersa var. *virescens* Moquin-Tandon, Hist. Moll. France, 1855, p. 175.

Helix aspersa var. *lutescens* Grateloup, Cat. Moll. France, 1855, p. 5.

Helix aspersa var. *luteola* Bourguignat, Mal. Alg., 1864, p. 103.

Helix aspersa var. *alba* Locard, Moll. Ain, 1881, p. 63.

Helix aspersa var. *lutea* Baudon, Journ. de Conch., 1884, p. 239.

Helix aspersa vars. *flavescens* and *virescens* Kregl., Verz., 1870, p. 133.

SHELL pale yellowish or whitish, without darker banding.

The var. *exalbida* in its widest sense embraces not only the whitish shells but those of various shades of yellow, including the specimens which display a tinge of green and have been discriminated as var. *virescens*.

This pretty form is not uncommon near Dartford amongst *Clematis vitalba*, and has also been found on *Pteris aquilina*. Miss Hele, who has found so many of this variety, has only found it amongst nettles and ivy.

It is easily bred in captivity, but, especially if fed upon lettuce, speedily degenerates, losing its delicacy of colouring, and the epidermis acquiring a dirty brownish shade.

The var. *exalbida* Moquin-Tandon, s.s., is described as uniformly whitish or slightly tinged with yellow.

The sub-var. *luteola* Gassies is uniform and pellucid yellow. The *luteola* of Bourguignat is entirely yellow, strongly malleated and shagreened, and the var. *luteola* of Lallemand is yellowish.

The sub-var. *lutea* is pale chrome-yellow, semi-transparent, and shagreened with opaque markings of similar shade, the lip and interior pure white.

The sub-var. *flavescens* is pale yellow.

The sub-var. *virescens* is described as of an uniform greenish-yellow.

ENGLAND AND WALES.

Channel Isles—Rare about Bordeaux Harbour, Guernsey, and has also been found near Fort Tourgis, Alderney (Tomlin and Marquand, J. of C., 1903, p. 287). Shells of a beautiful light greenish colour, sub-var. *virescens*, were found rarely near Bordeaux Harbour, Guernsey, in 1887, by Mr. Tomlin.

Cornwall W.—Truro! and Newquay, Sept. 1886, J. H. James.

Devon S.—Dawlish, 1840, Thos. Glover. Hedgebank between Topsham and Exeter, H. McMurdo. Otterton, Oct. 1893, Lionel E. Adams.

Devon N.—Woolacombe Bay (J. E. Cooper, Sci. Goss., 1897, p. 85).

Somerset S.—Canning near Bridgewater, E. W. Swanton.

Somerset N.—Common, Leigh Woods, 1878, Miss F. M. Hele. Not common in hedges, Portishead; and scarce in hedges at Cheddar, Miss Jessie Hele. Cuckoo Hill near Bruton, very local, but abundant, C. D. Heginbotham. Bratton St. Maur, at the cross roads known as "Jack White's Gibbet," E. W. Swanton.

Wilts. S.—About a mile from Devizes on the road to Nursted! C. D. Heginbotham.

Isle of Wight—A. Loydell.

Hants. S.—Garden, Stanpit Villa, Christchurch, June 1893! Charles Ashford. Fareham, C. S. Coles.

Sussex W.—Tolerably common on a stone wall facing the shore at Littlehampton, 1883, M. C. Atkinson. Sompting, 1882, R. Miller Christy. Worthing, Nov. 1883, B. M. Oakeshott. St. Leonards-on-Sea, W. J. Lewis Abbott. Sub-var. *virescens*, Cowfold, W. Borrer.

Sussex E.—Sub-var. *alba* not uncommon about Lewes (W. C. Unwin, Naturalist, 1853, p. 55). Under a wall near Meads, Eastbourne, 1878! Rev. S. Spencer Pearce. Seaford! also a colony at Newhaven, J. H. A. Jenner.

Kent E.—Ospringe, July 1883! Preston and Faversham, Miss E. B. Fairbrass. Folkestone, on the chalkhills, Mrs. Fitzgerald. Common but local near Walmer; and one specimen on the sandhills, Sandwich, J. E. Cooper. Eltham, Sept. 1891; and not rare about Canterbury, Lionel E. Adams.

Kent W.—Chislehurst Common, 1884, L. M. Cockerell. Common near Shepherdswell and Alkham, Rev. J. W. Horsley. Somewhat common but local near Dartford, T. D. A. Cockerell.

Surrey—Chalk lane, above station, Dorking, Sept. 1883 ! C. Ashford. Common but local with type near Warlingham, July 1883 ; and Godstone, 1884, T. D. A. Cockerell. Brockham Green, and hedges between Betchworth and Dorking, J. E. Cooper.

Essex N.—Occasionally found in Trinity Churchyard, Colchester, H. Laver. Common in the Manse garden, Tendring, near Colchester, Apr. 1897, Rev. E. Percy Blackburn. Saffron Walden, R. Miller Christy.

Oxford—As var. *alba* it is recorded from a hedgebank at the foot of Watlington Hills by the Rev. Dr. Norman (Zoologist, 1853, p. 4127).

Suffolk E.—Woodbridge, June 1887 ! Rev. S. Spencer Pearce. Blackhall, G. T. Rope. Bawdsey, H. B. Preston.

Norfolk E.—As var. *alba* it is recorded from beneath hornbeam hedges from the Roseary to the Asylum, Norwich (W. K. Bridgman, Zoologist, 1851, p. 3302). Not common, Hellesdon and Thorpe (Bellars, British Shells, 1858). A "white variety" at Catton and Thorpe (J. B. Bridgman, Norf. and Norw. Trans., 1872, p. 49). Not uncommon in hedges, Yelverton and Alghington ; also one specimen from Old Lakenham Churchyard, Rev. S. Spencer Pearce. On hawthorn and nettles, near the sea, Cromer, Rev. Dr. McMurtrie.

Cambridge—Near Cambridge, July 1873, W. G. Blatch. Linton, Sept. 1885 ! Thomas Rogers. In gardens, Cambridge, Hugh Watson.

Northampton—Rothwell, H. Beeston. Brigstock Churchyard, L. E. Adams. Kettering, C. E. Wright.

Gloucester E.—Birdlip (Webster, Nat., 1854, p. 157). Stroud, 1884 ! E. J. Elliott. Cooper's Hill, Cheltenham, Sept. 1883, J. Madison.

Gloucester W.—Westbury-on-Trym, 1874 ! Miss Jessie Hele. Near Stroud, 1884 ! E. J. Elliott.

Monmouth—Bigswear and Tintern-in-Wyedale, 1884 ! C. T. Musson.

Stafford—Mr. C. Ashford possessed specimens found in the county.

Glamorgan—By the shore, Llantwit Major, July 1884 ! F. W. Wotton.

Cardiff—Langharne, July 1886, C. Jefferys.

Pembroke—Near Tenby, July 1886, C. Jefferys. Rare, Gurfreston, A. G. Stubbs.

Lincoln N.—Common on Mablethorpe sandhills, Aug. 1886 ! H. Wallis Kew. Hubbards Hill, 1901, C. S. Carter. Kirton-in-Lindsey, July 1902, Rev. E. A. Woodruffe Peacock.

York S.E.—Fairly common about 1850 in the hedge-bottom bordering a small path between Lawrence street and Heslington road, York, W. M. Tuke. A strictly localized colony on a bridge-bank near Bridlington, Rev. W. C. Hey. Confined to a limited area on a hedge-bank at Hornsea, where it was first found in 1891 by Mr. J. W. Boulton.

York N.E.—Scarborough, W. Bean. Coxwold, Rev. T. A. Brode.

York S.W.—Pontefract, Apr. 1885 ! J. Wilcock. Doncaster, 1846 ! J. R. Hardy.

Durham—A colony of true and partial albinos on the sandhills, Seaton Carew, July 1909 ! W. Gygell.

Westmorland and Lake Lancashire.—Woodhead near Grange, April 1907, W. H. Heathcote.

SCOTLAND.

This form prefers the sea-coast, according to Dr. Buchanan White.

Aberdeen S.—(Macgillivray, Hist. Moll., 1843, p. 80).

IRELAND.

Mayo W.—On the ruined walls of Moyne Abbey near Killala (Miss Warren, Zoologist, 1879, p. 26).

Galway W.—Several on terraces and walls between Kilronan and Killeany, Inishmore, Aran Islands, July 1895, R. Standen.

CONTINENTAL DISTRIBUTION.

France—Mr. W. E. Clarke collected the var. *exalbida* at Arles in the Bouches du Rhône ! and Moquin-Tandon enumerates as localities Bastia and Sartene in Corsica.

As var. *lutea* it is cited by Dr. Baudon from very shady old walls in the wood of Angy, Oise ; from Perpignan, Pyrénées Orientales, and from Agen, Lot-et-Garonne ; also by Prof. de Nerville from Royan, Charente Inférieure.

Sub-var. *luteola* is quoted as found in the Agenais by Dr. Gassies.

Sub-var. *lutescens* is cited by Dr. Grateloup as found in Southern and Western France ; M. Letourneaux records a pale bandless form from the grottoes of Bre-louse, Vendée ; and M. Régelsperger gives Rochefort-sur-Mer, Charente Inférieure, as a locality. Locard says the var. "*alba*" Moquin is rare in the department of the Ain ; and Sayn cites albino shells from Crussol, Ardèche.

Sub-var. *virescens* enumerated for the Oise by Dr. Baudon ; and Requien quotes it by the term "*virescens concolor*" for Bastia, Corsica.

Italy—Signor Valentini records this variety from a garden in the Tronto Valley in the Marches.

Spain—Dr. Hidalgo cites a greenish yellow variety from Valencia.

Sicily—Signor Benoit cites the var. *exalbida* as var. *tota flavescens, immaculata* = *H. secunda* Costa; and the sub-var. *virescens* as "*tota virescens immaculata*" for that island.

Malta—Major E. F. Becher has also found it in Malta.

Algeria—Sub-var. *luteola* from the Isle Maudite, the environs of Bône, Oran, and the Calle, by Bourguignat; and from shaded hills near Algiers by Lallemand.

Var. unicolor Moquin-Tandon, Hist. Moll. France, 1855, p. 175.

Helix aspersa var. *rufescens* Picard, Moll. Somme, 1840, p. 181.

Helix aspersa var. *grisea* Moquin-Tandon, Hist. Moll. France, 1855, p. 175.

Helix aspersa var. *immaculata* Kregl. Verz., 1870, p. 133.

SHELL clear uniform fawn colour.

The sub-var. **immaculata** is described as bandless and unicolorous.

The sub-var. **grisea** is of an uniformly fulvous or greyish tint, with faint and hardly visible traces of spiral banding. Moquin-Tandon is of opinion that the *Helix grisea* of Gmelin is identical with this form.

The sub-var. *grisea* is recognized as quite a local race in some districts, and Rev. Father Florence has observed that elevated mountainous places tend to yield these unicolorous shells with indistinct markings.

The var. **rufescens** of Picard is described as having the ground tint of the shell rufous or fawn colour, but it is not clear that unicolorous shells were intended to be described.

ENGLAND AND WALES.

Channel Isles—Guernsey ! R. D. Darbishire.

Cornwall E.—Sub-var. *grisea*, Fowey ! (Alder Coll., Newcastle Museum).

Devon S.—Torquay, S. Tuke. Dawlish, 1840, Thos. Glover. Teignmouth ! Thomas Rogers. Sub-var. *grisea*, Torquay, Oct. 1883, C. Ashford. Teignmouth, Oct. 1888 ! Loftus St. G. Byne.

Devon N.—Sub-var. *grisea*, Northam, May 1885 ! W. A. Gain. Twitchen, Mortehoe, Oct. 1907 ! Mrs. Longstaff.

Somerset S.—Sub-var. *grisea*, near Porlock, Aug. 1892, L. E. Adams. Yeovil, W. Gyngell.

Somerset N.—Var. *unicolor*, Bath, June 1886 ! Miss Fairbrass. Rare, Freshford, Aug. 1883 ! Miss Jessie Hele. Hatch Beauchamp near Taunton, Rev. E. W. W. Bowell. Sub-var. *grisea*, Leigh Woods, 1877, Miss Hele; Coombe Down, Bath, Mrs. Oldroyd.

Hants. S.—Var. *unicolor* and sub-var. *grisea*, Horndean, Sep. 1882 ! J. Madison. Sub-var. *grisea*, Hambledon, 1904 ! C. S. Coles.

Sussex W.—Var. *unicolor* and sub-var. *grisea*, Worthing. B. M. Oakeshott. Sub-var. *grisea*, Clayton, June 1883, E. F. Becher. Littlehampton, 1884, Rev. Dr. McMurtrie. Var. *unicolor* and sub-var. *grisea*, Lancing, May 1909 ! F. Rhodes.

Kent E.—Sub-var. *grisea*, Minster, Nov. 1883, S. C. Cockerell. Folkestone, Mrs. Fitzgerald. Barton Court, Buckland, Dover, Rev. R. Ashington Bullen. Canterbury, formula 10040, L. E. Adams.

Surrey—Sub-var. *grisea*, Godstone, Sept. 1884, T. D. A. Cockerell. Dorking, Charles Ashford.

Oxford—Sub-var. *grisea*, along a hedgebank at the foot of Watlington Hill, Rev. Dr. Norman.

Norfolk E.—Sub-var. *grisea*, Yelverton, Rev. S. Spencer Pearce. Hellesdon, A. Mayfield. Cromer, Rev. Dr. McMurtrie.

Worcester—Var. *unicolor*, Kings Norton ! J. Hopkins.

Glamorgan—Sub-var. *grisea*, Cardiff, 1888 ! F. W. Wotton.

Carmarthen—Sub-var. *grisea*, Whitland, May 1885 ! C. G. Barrett.

Pembroke—Sub-var. *grisea*, Tenby, Rev. Dr. McMurtrie.

Denbigh—Sub-var. *grisea*, Great Orme's Head, Rev. W. C. Hey.

York S.E.—Bridlington ! F. Booth.

Lincoln N.—Var. *unicolor*, Broughton, Rev. E. A. Woodruffe-Peacock. Sub-var. *grisea*, Cleethorpes, Sep. 1885 ! J. R. Hardy. Willoughby, Aug. 1908, J. F. Musham.

Isle of Man—Sub-var. *grisea*, Glen Helen, May 1883 ! J. Ray Hardy.

CONTINENTAL DISTRIBUTION.

France—Recorded for Toulouse, Haute Garonne, by Moquin-Tandon; for Nîmes, Gard, by Clement; for Hérault, by Dubrueil; for the vicinity of Paris by Pascal; for Bordeaux, Gironde, by Dr. Scharff; and Abbe Dupuy records the finding in 1840 of a perfectly unicolorous grey specimen near Auch, Gers; Cailliaud gives Loire Inférieure; and Rev. Father Florence records unicolorous shells with indistinct markings from an altitude of over 2,000 feet on the summit of Mount Boussicant, in the Var.

Sub-var. *grisea* is cited for the Hérault by Dubrueil; for the Ain by Locard; for Toulouse, Haute Garonne, by Moquin-Tandon; for Bordeaux, Gironde, by Dr. Scharff; for Angoulême, Charente, by Prof. de Neville; and for Rochefort-sur-Mer, Charente Inférieure, by Régelsperger.

Spain—Staff-Surgeon Jones found only one specimen on the Rock of Gibraltar.

Italy—Dr. Pantanelli records sub-var. *grisea* from Spoleto, Umbria. In Sardinia Staff-Surgeon K. H. Jones reports that half the specimens found at Aranci Bay belong to the var. *unicolor*; Marchesa Paulucci also records it from Monte Santo di Pula, and sub-var. *grisea* from Tacquisara.

Algeria—Specimens of sub-var. *grisea*, labelled "*Helix aspersa*, Constantine, Hon. A. Russell," in the British Museum, Sept. 1886!

Var. nigrescens Moquin-Tandon, Hist. Moll. France, 1855, p. 175.

Helix aspersa var. *B. brunnea* Gassies, Moll. Agenais, 1849, p. 82.

SHELL blackish or brown-black, very smoky, and nearly unicolorous.

The sub-var. **brunnea** is described as destitute of banding.

ENGLAND AND WALES.

Devon N.—Very thin specimens at foot of walls among coarse grass, Ilfracombe, Aug. 1903 (Beeston and Wright, Journ. of Conch., 1904, p. 74).

Somerset N.—A specimen "literally as black as ink," Burnham, 1876, Miss F. M. Hele. Hedge-banks, Bratton St. Maur, E. W. Swanton.

Kent E.—Broadstairs, Sept. 1909! F. H. Sikes.

Northampton—Woodend, A. Loydell.

Worcester—King's Norton! F. Booth.

Glamorgan—Terrace road, Swansea, H. R. Wakefield.

Pembroke—On North Cliff and in gardens, Tenby, A. G. Stubbs.

Cardigan—Aberayron, May 1888! E. Collier.

Lincoln N.—Howsham, May 1901, Rev. E. A. Woodruffe-Peacock. Hubbard's Valley, Louth, Aug. 1902, C. S. Carter. Lincoln, May 1908, J. F. Musham.

York N.E.—Scarborough! J. A. Hargreaves.

York Mid W.—Ripon! F. Rhodes.

SCOTLAND.

Haddington—North Berwick! Rev. Dr. McMurtrie.

Aberdeen S.—(Macgillivray, Hist. Moll., 1843, p. 80).

IRELAND.

Antrim—A dark almost unicolorous specimen in greenhouse, Murlough, Sept. 1896, R. Standen.

Sligo—Dunes near Raghly, July 1904 (Welch & Stelfox, Irish Nat., 1904, p. 189). Sligo, April 1908, F. H. Sikes.

Mayo W.—Clare Island, 1909! R. Welch.

Cork—Many specimens almost entirely black, July 1907 (Welch and Stelfox, Irish Nat., Sept. 1907, p. 281).

CONTINENTAL DISTRIBUTION.

France—Common about Paris according to Pascal. Régelsperger cites it as rather common at Rochefort-sur-Mer, Charente Inférieure; Abbe Dupuy has collected uniform black specimens at Preste, Pyrénées Orientales; and Grateloup gives the var. *nigricans* as found about Bordeaux, Gironde. As var. *brunnea*, Gassies records it for the Agenais.

Belgium—St. Gilles near Brussels (Van den Broeck, Ann. Soc. Mal. Belg., 1870, p. 20).

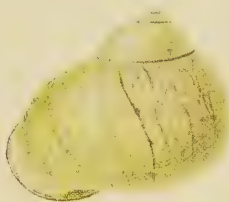
Malta—According to Dr. Gulia, the black variety is occasionally found.

Loyalty Islands—Specimens almost black recorded by Melvill and Standen, J. of Conch., July 1896, pp. 87 and 132).

HELIX ASPERSA Müller.



Helix aspersa var. *fasciata* Moq.
Acton, Middlesex, T. D. A. Cockerell.



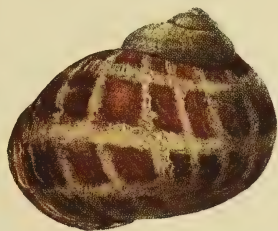
Helix aspersa var. *exalbida* Moq.
Leigh Woods, Bristol, Miss Hele.



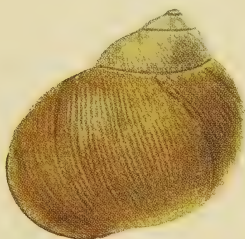
Helix aspersa sub-var. *monozona* Taylor.
Hambleton, Hants., L. Dawes.



Helix aspersa sub-var. *semifusca* Cockerell.
St. Mary Cray, Kent, T. D. A. Cockerell.



Helix aspersa var. *clathrata* Taylor.
Banff, Thos. Edwards.



Helix aspersa var. *insolida* Monts.
Trapani, Sicily, Marquis Monterosato.



Helix aspersa sub-var. *marmorata* Moq.
North Berwick, N.B., Rev. Dr. McMurtrie.



Helix aspersa sub-var. *obscurata* Moq.
North Berwick, N.B., Rev. Dr. McMurtrie.

VARIATIONS IN THE SPIRAL MARKINGS OF THE SHELL.

Var. **fasciata** Picard, Moll. Somme, 1840, p. 181.

Helix aspersa var. *a zonata* Menke, Syn. Moll., 1830, p. 16 (*sine desc.*).

Helix aspersa var. *albescens* Picard, Moll. Somme, 1840, p. 181.

Helix aspersa var. *quinquefasciata* Requier, Cat. Moll. Corse, 1848, p. 43.

Helix aspersa vars. *zonata* and *obscurata* Moquin-Tandon, Hist. Moll. France, 1855.

Helix aspersa var. *albofasciata* Jeffreys, Brit. Conch., 1862, vol. i., p. 181.

Helix aspersa vars. *fasciata*, *puncticulata*, *brunnea*, and *virescens* Baudon, J. de C., 1884, p. 240.

Helix aspersa var. *semifusca* Cockerell, Sci. Goss., May 1886, p. 98.

Helix aspersa var. *rufulozonata* Stubbs, Journ. of Conch., July 1900, p. 324.

Helix aspersa var. *monozona* Taylor, sub-var. nov.

Helix aspersa var. *lutescens* T. D. A. Cockerell MSS.

SHELL with more or less distinct spiral bands.

The var. **fasciata** s.s., is described as possessing from two to five brown or brownish spiral bands on a fawn or reddish ground; the sub-var. *fasciata* Baudon is identical but has usually only three bands.

The sub-var. **zonata** Moq. is rufous or yellowish, with five dark spiral bands, but is here restricted to shells with the yellowish ground colour (Monog., vol. i., pl. 1, f. 1).

The sub-var. **albescens** is whitish, fasciated or flamed with reddish. The sub-var. *rufulo-zonata* which has a pale yellow ground with translucent reddish banding and the sub-var. *lutescens* Cockerell MSS., described as yellow with pale red-brown bands, are practically identical with or slight modifications of the sub-var. *albescens*.

Draparnaud would appear to indicate this variety in his *Helix aspersa* β *lutescens* aut *virescens*, *fasciis pallidè rufis*.

The sub-var. **albofasciata** is reddish-brown with a white band at the periphery. The banding may be denoted by the formula (123) (45) (Monog., vol. i., pl. 1, f. 2).

The sub-var. **semifusca** has the chocolate-brown banding on the upper side of the whorls completely coalesced, the formula being (123)45.

The sub-var. **obscurata** is described as dark rufous, with broad but more or less indefinite pale brown bands.

The sub-var. **brunnea** Baudon (not Gassies) is described as brown with yellow spiral banding and ornamentation.

The sub-var. **virescens** Baudon is described as being of a greenish-brown ground colour with yellow banding and ornamentation.

The sub-var. **puncticulata** is described as reddish with traces of a yellow peripheral line and numerous punctiform yellow markings.

The sub-var. **monozona** sub-var. nov., is of typical ground colour with one distinct peripheral black band. Formula 00300.

ENGLAND AND WALES.

Channel Isles—Sub-var. *zonata*, rare in Guernsey and Herm; more common on the cliffs, Alderney (Tomlin and Marquand, Journ. of Conch., vol. x., p. 287). Sub-var. *albofasciata*, Vaux Valley, Jersey, April 1905, F. H. Sikes.

Cornwall W.—A specimen of the var. *fasciata*, found at Newquay by Mr. J. H. James in 1887, showed seven distinct bands on a sepia-brown ground colour, the formula being 122345. Sub-vars. *albofasciata* and *lutescens*, Truro! J. H. James.

Devon S.—Sub-var. *albofasciata*, Teignmouth, Oct. 1888! L. St. G. Byne. Sub-var. *lutescens*, Torquay, May 1887, F. W. Wotton.

Devon N.—Sub-var. *albofasciata*, Northam, Sept. 1889, W. A. Gain. Sub-var. *zonata*, sand dunes, Woolacombe, Mrs. Longstaff.

Somerset N.—Sub-var. *zonata*, Cheddar, 1876, Miss F. M. Hele. Bratton St. Maur, E. W. Swanton. Sub-var. *albofasciata*, tolerably common on hedgebanks, near the "Cross Roads," Bratton St. Maur, E. W. Swanton.

Wilts. N.—Marlborough, E. W. Swanton.

Wilts. S.—Sub-var. *albofasciata*, Devizes, C. D. Heginbotham; Edington, E. W. Swanton.

Isle of Wight—Sub-var. *albofasciata*, Carisbrook Castle, June 1882! C. Ashford.

Hants. S.—Sub-var. *zonata*, Christchurch and Beaulieu Abbey, Aug. 1885! Chas. Ashford. Portsdown Hill, C. S. Coles. Sub-var. *albofasciata*, Fareham, Aug. 1905, F. H. Sikes. Sub-var. *monozona*, Hambledon! L. Dawes.

Hants. N.—Sub-var. *zonata*, Preston Candover, July 1883! Rev. H. P. Fitzgerald. Sub-var. *albofasciata*, Abbotston Down and Drummer Lane, Swarraton, July 1890! Rev. W. L. W. Eyre.

Sussex W.—Var. *fasciata* s.s., Lancing, May 1909! F. Rhodes. Sub-var. *zonata*, Worthing, 1883! B. M. Oakeshott. Sub-var. *albofasciata*, a colony at Worthing, A. Loydell; and sub-var. *albescens*, Littlehampton! Rev. Dr. McMurtrie.

Sussex E.—Sub-var. *zonata*, Lewes, 1884 ! R. D. Darbshire. Wilmington near Eastbourne, Sept. 1908, W. E. Brady.

Kent E.—Sub-var. *zonata*, abundant on the chalk-hills ; and sub-vars. *zonata* and *albofasciata*, Folkestone, March 1882 ! Mrs. Fitzgerald. Eltham, Canterbury, formula 12005, Sep. 1891, L. E. Adams.

Kent W.—Sub-var. *semifusca*, Chislehurst, T. D. A. Cockerell.

Surrey—Sub-var. *zonata*, Haslemere, C. Pannell, jun. Hedgebank, Norbury Park, A. Reynell. Sub-var. *albofasciata*, not uncommon at Godalming, H. W. Kidd.

Suffolk E.—Sub-var. *zonata*, Mendlesham, A. Mayfield.

Norfolk E.—Sub-var. *zonata*, Upper Hellesdon & sub-var. *albofasciata*, Drayton, 1896, A. Mayfield. Sub-var. *albescens*, Thorpe near Norwich, and Cromer, 1885 ! Rev. Dr. McMurtrie.

Norfolk W.—Sub-var. *zonata*, Felsham and Lavenham, A. Mayfield.

Cambridge—Var. *fasciata*, in the coprolite workings in meadows frequently overflowed by the Cam, near Meldreth, Sept. 1883 ! H. G. Fordham.

Northampton—Sub-var. *zonata*, Brackley, A. Loydell.

Gloucester E.—Sub-var. *zonata* and a sub-var. of *semifusca* with formula (123)00, near Stroud, Aug. 1884 ! E. J. Elliott. Sub-var. *albofasciata*, Gloucester, Sept. 1883, and sub-var. *lutescens*, with band-formula 1(23)45, Prestbury near Cheltenham, J. Madison.

Gloucester W.—Sub-var. *albofasciata*, Westbury-on-Trym, 1874, Miss Jessie Hele.

Hereford—Sub-var. *albofasciata*, not uncommon, Hereford, Dormington, and Townhope (Boycott and Bowell, Hereford List, 1899).

Glamorgan—Sub-vars. *zonata* and *albofasciata*, Lantwit Major, May 1886 ! also specimens from near Cardiff related to sub-vars. *brunnea* and *puncticulata*, F. W. Wotton.

Pembroke—Sub-var. *albofasciata*, not common, Marsh road and Holloway Quarry, Tenby ; sub-var. *rufulozonata*, two specimens in Narberth road, and one in Deer Park, Tenby ; and sub-var. *zonata*, Giltar, South Cliff, The Burrows, etc., Tenby, A. G. Stubbs. Penally, Oct. 1897 ! H. Rowland Wakefield.

Denbigh—Sub-var. *zonata*, Llandudno, July 1885 ! E. Collier.

Anglesey—Sub-var. *zonata*, Penmon ! and sub-var. *albofasciata*, near Red Wharf Bay, Aug. 1883 ! John Hopkinson.

Lincoln S.—Sub-var. *zonata*, Grey Lees Pits, Rauceby, Sep. 1897 ! W. D. Roebuck.

Lincoln N.—Sub-var. *zonata*, Mablethorpe sandhills, Aug. 1888 ! H. W. Kew ; Gayton-le-Wold, March 1876 ! W. D. Roebuck ; and Kirton-in-Lindsey, May 1902, Rev. E. A. Woodruffe-Peacock. Sub-var. *albofasciata*, Kirton-in-Lindsey, 1902, Rev. E. A. Woodruffe-Peacock ; Nettleham, Sept. 1906 ; Lincoln, April 1908 ; and sub-vars. *albofasciata* and *lutescens*, Willoughby, Oct. 1908 ! J. F. Musham.

Leicester and Rutland—Sub-var. *albofasciata*, Dane Hills, Leicester, Oct. 1886 ! H. E. Quilter.

Notts.—Sub-var. *albofasciata*, Mansfield, April 1882, Edgar Pickard.

Lancashire Mid—Sub-var. *zonata*, Morecambe, June 1883 ! W. West. Sub-var. *albofasciata*, Torrisholme, Morecambe, Aug. 1905, H. Beeston.

York S.E.—Sub-var. *zonata*, Cottingham, Bridlington, and Burstwick ; and sub-var. *albofasciata*, Kelsey Hill, and by Pearson's Park, Hull, A. J. Moore.

York N.E.—Sub-var. *lutescens*, Hutton-Bushel near Scarborough, Sept. 1909 ! W. Gyngell.

York S.W.—Sub-var. *albofasciata*, Knottingley, Sept. 1885, R. D. Darbshire. Wakefield, 1883, J. Wilcock.

Westmorland and Lake Lancs.—Sub-var. *albofasciata*, Grange, April 1884 ! W. Denison Roebuck ; and Grange Fell road, Grange, H. Beeston.

Isle of Man—Sub-var. *albofasciata*, Peel, Aug. 1894, R. Cairns.

SCOTLAND.

Haddington—Sub-vars. *zonata* and *obscurata*, N. Berwick ! Rev. Dr. McMurtrie.

Cantire—Sub-var. *zonata*, Tarbert, Aug. 1886 ! T. Scott.

Mid Ebudes—Sub-var. *albofasciata*, Iona, Sept. 1889 ! Rev. J. E. Somerville.

IRELAND.

Antrim—Sub-vars. *albofasciata* and *lutescens*, cliffs, Whitepark Bay, R. Welch.
Wexford—Sub-var. *albofasciata*, Kilmanock, New Ross, Mar. 1888 ! G. Barrett-Hamilton.

Mayo W.—Sub-var. *obscurata*, shell-mounds, Keel, Achill Isles, J. G. Milne.

Waterford—Sub-var. *zonata*, Tramore, Rev. A. H. Delap.

Kerry—Sub-var. *zonata*, Kenmare, July 1898 ! R. Standen.

CONTINENTAL DISTRIBUTION.

Belgium—Sub-var. *obscurata*, St. Gilles near Brussels, E. van den Broeck.

France—The var. *fasciata* and sub-var. *albescens* are based upon specimens from the Somme.

The sub-var. *zonata* in its widest sense has been recorded by Moquin-Tandon from Toulouse, Haute Garonne; by M. Pascal from the environs of Paris; by de l'Hôpital from Calvados; by Dubrueil from Hérault; by Clement at Nîmes, Gard; Mr. Darbshire has found it at Nice, Alpes Maritimes; Mr. F. H. Sikes at Granville, Manche; and Locard records it as a common variety in the Ain, but not common about Lyons.

The sub-vars. *brunnea* and *virescens* Baudon are listed for the Oise; and the sub-var. *puncticulata* is stated to be rare in St. Laurent's Quarries in the same department.

The sub-var. *albofasciata* found at Granville, Manche, by Mr. F. H. Sikes.

The sub-var. *obscurata* was found by Mr. S. C. Cockerell rather commonly at Veules-en-Caux, Seine Inférieure; and recorded by Dubrueil for the Hérault; by Moquin-Tandon for Toulouse, Haute Garonne; and by Locard as common in the Ain and uncommon about Lyons.

Italy—Dr. Pantanelli records sub-var. *obscurata* from Spoleto, Umbria; and Marchesa Paulucci the sub-var. *zonata* from S. Pietro di Pula, Sardinia.

Asia Minor—Sub-var. *zonata*, recorded by Retowski for Sinope in Kastumuni, and with two and three bands only at Adalia, Karaman, by Clessin.

Algeria—Sub-var. *obscurata* is quoted by Bourguignat as occurring sporadically.

VARIATION WITH SPIRAL AND TRANSVERSE MARKINGS.

Var. clathrata Taylor, var. nov.

SHELL with the dark ground colour broken up into somewhat regular though oblique quadrilateral blocks by broad and pale spiral and transverse lines.

This variety is fairly well represented in Reeve's British Mollusks, p. 59.

ENGLAND AND WALES.

York S.E.—Bridlington, July 1892 ! H. E. Craven.

Anglesey—Marianglas, May 1905 ! C. Oldham.

SCOTLAND.

Banff Banff ! Thos. Edwards.

CONTINENTAL DISTRIBUTION.

France—Granville, Manche, Sept. 1907 ! F. H. Sikes.

VARIATIONS IN TRANSVERSE MARKINGS OF THE SHELL.

Var. flammea Picard, Moll. Somme, 1840, p. 181.

Helix aspersa var. *undulata* Moquin-Tandon, Hist. Moll. France, 1855, p. 175.

Helix aspersa var. *concolor-pallida* Shutt., Moll. Corse, 1843, p. 17, t. Moq.

Helix aspersa var. *marmorata* Moquin-Tandon, op. cit.

This variety embraces those forms in which the darker spiral banding has become obliterated by the diffusion of their pigment and in which there is a tendency of the pale flammular markings to coalesce and form transverse bands, alternating with darker areas.

The var. *flammea*, s.s., is described as destitute of spiral banding, but with paler flammules and transverse bands (Monog., vol i., pl. 1, f. 3).

The sub-var. *undulata* is described as smaller, very thin and transparent; of a rufous colour, with sharply-marked brown and whitish longitudinal undulations.

The sub-var. *marmorata* is of a fawn or greyish colour with brown marblings.

ENGLAND AND WALES.

Channel Isles—The var. *flammea* has been found in Jersey by Mr. F. H. Sikes. Sub-var. *undulata*, Longueville ! W. Cash, and St. Helier's, Rev. Dr. McMurtrie.

Cornwall W.—Var. *flammea*, Truro ! J. H. James. Porthleven, Rev. J. W. Horsley. Sub-var. *undulata*, Newlyn, Penzance, Aug. 1885 ! Rev. Dr. McMurtrie. Newquay, uncommon ! J. H. James. Porthleven, Rev. J. W. Horsley.

Devon S.—Sub-var. *undulata*, Torquay, 1884, B. M. Oakeshott. Teignmouth, L. St. G. Byne. Topsham, Aug. 1892, L. E. Adams.

Devon N.—Sub-var. *undulata*, Northam, 1885 ! W. A. Gain. Lynton, Aug. 1892, L. E. Adams. Barnstaple, Aug. 1893 (Beeston & Wright, J. of C., 1904, p. 81). Var. *flammea*, common on walls, Twitcheen, Morthoe, Mrs. Longstaff.

- Somerset N.**—Sub-var. *undulata*, Uphill near Weston-super-Mare, Sept. 1885 ! J. Madison. Holbrooke near Wincanton, E. W. Swanton.
- Wilts. N.**—Var. *flammea*, Collingbourne, E. W. Swanton ; and Devizes, C. D. Heginbotham.
- Dorset**—Sub-var. *undulata*, Portland, E. R. Sykes.
- Hants. S.**—Var. *flammea*, Fareham, Aug. 1905, F. H. Sikes. Sub-var. *undulata*, Holmsley, Christchurch, and Beaulieu Abbey, Aug. 1885, C. Ashford. Portsdown Hill, C. S. Coles.
- Hants. N.**—Var. *flammea* and sub-var. *undulata*, Drummer lane, Swarraton, July 1890 ! Rev. W. L. W. Eyre. Sub-var. *undulata*, Preston Candover, 1883 ! Rev. H. P. Fitzgerald.
- Sussex W.**—Sub-var. *undulata*, Worthing, Aug. 1884, T. D. A. Cockerell. Littlehampton, 1885 ! Rev. Dr. McMurtrie.
- Sussex E.**—Var. *flammea* and sub-var. *undulata*, Lewes ! J. H. A. Jenner.
- Kent E.**—Sub-var. *undulata*, Folkestone, Sept. 1885, E. Collier.
- Kent W.**—Sub-var. *undulata*, Kenley, Aug. 1885 ! T. D. A. Cockerell.
- Oxford**—Sub-var. *undulata*, Wychwood and Charlbury ; one in Wychwood Forest, (W. E. Collinge, Conchologist, 1891, p. 21).
- Suffolk E.**—Var. *flammea*, Mendlesham ! A. Mayfield.
- Norfolk E.**—Var. *flammea*, very common about Earlham, Colney, Hellesdon ! and Drayton, A. Mayfield.
- Norfolk W.**—Var. *flammea*, King's Lynn, Sept. 1894, T. Peteh. Haughley, Wetherden, Whepstead, and Lavenham, A. Mayfield.
- Northampton**—Sub-var. *undulata* is the prevailing form about Northampton, Lionel E. Adams, Oct. 1893. Thorpe nr. Peterborough, 1884 ! Rev. Dr. McMurtrie.
- Monmouth**—Var. *flammea*, roadside, Newport, Aug. 1892, L. E. Adams. Sub-var. *undulata*, Chepstow Castle, April 1909 ! F. H. Sikes.
- Hereford**—Var. *flammea*, on stone walls, Tupsley, Boycott and Bowell.
- Worcester**—Sub-var. *undulata*, Droitwich, July 1883, Miss Fairbrass.
- Warwick**—Sub-var. *undulata*, Stratford-on-Avon, July 1892 ! H. E. Craven.
- Salop**—Sub-var. *undulata*, Oswestry, June 1885 ! B. Hudson.
- Glamorgan**—Var. *flammea*, Cardiff ! F. W. Wotton. Sub-var. *undulata*, Swansea ! H. R. Wakefield.
- Pembroke**—Var. *flammea*, Tenby, July 1890, Rev. W. L. W. Eyre. Sub-var. *undulata*, New Milford, July 1885 ! G. W. Oldfield ; common about Tenby, A. G. Stubbs. Var. *flammea* and sub-var. *undulata*, Penally, H. R. Wakefield.
- Cardigan**—Sub-var. *undulata*, Aberystwyth, May 1888 ! E. Collier.
- Montgomery**—Sub-var. *undulata*, Welshpool, J. Bickerton Morgan.
- Denbigh**—Var. *flammea* & sub-var. *undulata*, Llandudno, Sep. 1884 ! E. Collier.
- Lincoln S.**—Sub-var. *undulata*, Bourne, Aug. 1888 ! H. Wallis Kew. Little Ponton, Rev. E. A. Woodruffe-Peacock.
- Lincoln N.**—Var. *flammea* and sub-var. *undulata*, Mablethorpe sandhills, Aug. 1888 ! H. Wallis Kew. Lincoln and Welton, May 1907, J. F. Musham. Hubbard's Valley, Louth, 1901, C. S. Carter. Var. *flammea*, Hubbard's Valley ; Wyham, and Withern, 1900, C. S. Carter. Hibaldstow, March 1900, and Kirton-Lindsey, May 1902, Rev. E. A. Woodruffe-Peacock. Little Cotes, Sept. 1902, A. Smith.
- Leicester and Rutland**—Sub-var. *undulata*, canal side, Belgrove, June 1885 ! and ruins in Bradgate Park, Sept. 1885 ! H. E. Quilter.
- Notts.**—Var. *flammea*, Worksop, April 1885 ! W. A. Gain.
- Lancashire Mid**—Var. *flammea*, Deep Cutting, Lancaster, J. Davy Dean, and lane near canal, Torresholme, Morecambe, H. Beeston. Sub-var. *undulata*, Scotforth, Lancaster, J. Davy Dean.
- York S.E.**—Var. *flammea*, Burstwick, T. Peteh.
- York N.E.**—Var. *flammea*, Scarborough ! J. Ray Hardy. Ingleby Greenhow, Rev. J. Hawell. Sub-var. *undulata*, Redcar, July 1870 ! Jas. Abbott. Castle Hill, Scarborough, J. A. Hargreaves. Sub-var. *undulata*, Middlesbrough, 1892 ! H. E. Craven.
- York S.W.**—Sub-var. *undulata*, Knottingley ! R. D. Darbishire. Kexbro', Barnsley, July 1904 ! W. E. Brady. Conisborough, July 1891, L. E. Adams.
- York Mid W.**—Sub-var. *undulata*, Ingleton, Aug. 1888 ! E. Collier.
- Cheviotland**—Sub-var. *undulata*, Baniburgh, Aug. 1885 ! Rev. Dr. McMurtrie.
- Isle of Man**—Var. *flammea* and sub-var. *undulata*, near Peel, 1884 ! J. Madison. Scarlet Point, 1887 ! E. Collier. Port Erin, 1890, Lionel E. Adams. Var. *flammea*, Douglas ! F. Taylor. Sub-var. *undulata*, Pool Vaash, Aug. 1892, R. Cairns.

SCOTLAND.

Haddington—Sub-var. *undulata*, North Berwick ! Rev. Dr. McMurtrie.

Aberdeen S.—Prof. Macgillivray describes this variety (sub-var. *undulata*) as the prevailing form about Aberdeen.

IRELAND.

Antrim—Sub-var. *undulata*, Murlough, Sept. 1896 ! R. Standen.

Donegal—Var. *flammea*, Ballyshannon ! J. G. Milne.

Louth—Var. *flammea*, Carlingford, P. H. Grierson. Sub-var. *undulata*, Grange, Dec. 1904, P. H. Grierson.

Leitrim—Sub-var. *undulata*, on banks of Shannon, Rossy, J. G. Milne.

Sligo—Var. *flammea*, Sligo, Apr. 1908, F. H. Sikes. Sub-var. *undulata*, Glencar, July 1904, Welch and Stelfox.

Mayo W.—Sub-var. *undulata*, on the shell mounds, Keel, Achill Islands, J. G. Milne. Lough Carra, July 1906 ! R. Ll. Praeger.

Cork—Var. *flammea* is, according to Messrs. Welch and Stelfox (Irish Nat., Sept. 1907, p. 281) the predominating form in Cork. Very common about Cork, A. W. Stelfox.

CONTINENTAL DISTRIBUTION.

France—Var. *flammea* is cited by Moquin-Tandon for Toulouse, Haute Garonne; recorded by de l'Hôpital for Calvados; by Clement for Nîmes, Gard; by Dubrueil for Hérault; by Abbe Dupuy for Preste, Pyrénées Orientales; by Régelsperger for Rochefort-sur-Mer, Charente Inférieure; and for the Somme by Picard.

Sub-var. *undulata* is cited by Moquin-Tandon for Toulouse, Haute Garonne; and was collected at Veules-en-Caux, Seine Inférieure, in Aug. 1885 ! by Mr. S. C. Cockerell; at Granville, Manche, Sept. 1907 ! by Mr. F. H. Sikes; it is also recorded from Corsica by Blauner.

Sub-var. *marmorata* is said by Pascal to be common about Paris; by Dubrueil it is recorded for the Hérault; and by Locard as common in the department of the Ain.

Italy—Marchesa Paulucci cites sub-var. *zonata* for S. Pietro di Pula, Sardinia.

Spain—Mr. W. Eagle Clarke collected specimens of var. *flammea* in May 1889 within the republic of Andorra in the Pyrenees.

Staff-Surgeon K. H. Jones has collected the sub-var. *marmorata* at Arosa Bay, Galicia, where sixty per cent. of the specimens were this form. On Windmill Flats, Gibraltar, it is local, and only odd specimens were found on the rock.

In the Balearic Isles, the Rev. Canon Horsley found the sub-var. *undulata* in Majorca.

MONSTROSITIES.

Monst. *sinistrum* Férussac.

Helix (Acavus) aspersa m. *sinistra* Férussac, Tabl. Syst., 1821, p. 34, pl. 19, f. 1. 2.

SHELL sinistral or reversed in coiling.

ENGLAND AND WALES.

Devon S.—A very perfect specimen found by Mr. E. D. Marquand in May 1886 at Ashburton.

Somerset N.—Clevedon (Norman, Inland Moll. Somerset, 1860, p. 140). Bath, Miss F. M. Hele.

Hants. S.—Garden, Christchurch, June 1893, C. Ashford.

Sussex E.—Two dead but immature specimens found laid together in garden, Lewes, May 1897, C. H. Morris.

Kent W.—Dartford, Dr. Latham (Turton, Conch. Dict., 1819, p. 61).

Surrey—Two young specimens found in 1865 in Moss's Nursery Garden, Epsom; a single adult found in the following year in a private garden in the same town; one also found at Little Bookham (J. E. Daniel, Q. J. of Conch., i., p. 50, Feb. 1875). West Dulwich, C. H. Deadman.

Essex S.—In garden, Carswell, Barkingside, June 1882, H. Crouch.

Middlesex—Garden at Notting Hill, Henry Adams.

Norfolk E.—Var. *reversa*, an immature specimen found at Thorpe in 1851, and reared to maturity on *Convolvulus* leaves, W. K. Bridgman.

Gloucester E.—Cheltenham, 1877, Thomas Glover.

Gloucester W.—Paddy's lane, Bristol; Westbury-on-Trym, and Yate, Miss Hele.

Leicester and Rutland—Uppingham, 1866, J. E. Daniel.

Lancashire S.—Wall of Whalley Churchyard, May 1889, R. Standen. In a wet, old garden ditch near Churchtown, Southport, R. Drummond.

Lancashire Mid—A specimen, labelled "Morecambe," acquired by Mr. J. Ray Hardy from a collection formerly belonging to an old Manchester collector. Little Layton near Blackpool, R. Drummond.

York S.W.—Goole, G. H. Parke.

York N.E.—One on sandhills, Redcar, Rev. W. C. Hey; and enumerated by Mr. W. Bean as found at Scarborough.

York Mid W.—Two specimens found by Mr. Phillipson, one in Keighley Cemetery, and the other at Stockbridge near Keighley.

Westmorland & Lake Lancs.—A specimen from Ulverston in the Woodwardian Collection in the Cambridge Museum

Isle of Man—Wall, Douglas road, Peel, Aug. 1891, R. Cairns.

IRELAND.

Sligo—Sand dunes, Raghley, July 1904, A. W. Stelfox.

CONTINENTAL DISTRIBUTION.

France—Dr. Grateloup cites Rochelle, Charente Inférieure; Brest in Finistère; Dax in the Landes; and Bordeaux, Gironde, as localities where this form has been found. Dubrueil says it is rather frequently found about Montpellier, Hérault; de l'Hôpital cites Augherny near Caen, in Calvados; Mauduyt gives Vergne, Vienne; Goupil cites Le Mans in the Sarthe; and Régelsperger records it as very frequent about Rochelle, and as also found at Rochefort-sur-Mer, Charente Inférieure.

Dr. Jeffreys has recorded in "British Conchology," p. 182, that M. d'Orbigny had a colony of the sinistral monstrosity in his garden at Rochelle.

Africa—A specimen in the British Museum labelled "*Helix aspersa*, Africa," T. D. A. Cockerell, June 1885.

Victoria—A sinistral specimen found by Mr. R. Cairns amongst a number of the normal form sent from Geelong.

Monst. cornucopiæ Gmelin.

Cornu copie Born, Index Mus. Cæsar. Vindob. Testacea, 1778, p. 271. and plate.

Serpula cornu copie Gmelin, Syst. Nat., 1790, ed. xiii., vol. vi., p. 3745.

Cornu copie monstrosum Chemn., Conch. Cab., 1795, vol. xi., p. 292, tab. 211, ff. 2092, 2093.

Cornucopia helicina Shaw, Nat. Misc., 1803, xiv., p. 568.

Helix (Helicogena) aspersa monst. *β scalaris* Fér., Tabl. Syst., 1821, p. 34, pl. 19, ff. 3-9.

SHELL elongated, and the whorls more or less dislocated; in extreme examples resembling the cornucopia or "horn of plenty."

ENGLAND AND WALES.

Cornwall W.—A cornucopia-shaped specimen, found in the garden of Mawnan Sanctuary near Falmouth by Rev. W. Roger, is now in the Truro Museum.

Somerset N.—Specimens, resembling *Vivipara vivipara* in form, found on the cliffs towards Ladies' Bay, Clevedon, by Rev. Canon Norman. Two fine elongately scalarid shells from the "creel" of a "wall-fish" collector at Bruton! E. W. Swanton. Bath, Mrs. Oldroyd.

Devon S.—A specimen, labelled "var. *scalaris*, Honiton," in the Alder Collection, Newcastle Museum. A specimen, labelled "var. *subscalare*," in the Parfitt Collection, Exeter Museum, and probably collected in the vicinity. A specimen found in Devonshire by Mr. Johns, of Plymouth, is figured in Leach's Moll. Great Brit., plate ii., fig. 2.

Isle of Wight—Ventnor, Dr. Gray (Venables' Guide to I. of Wight, 1860, p. 463).

Kent W.—Chislehurst, July 1885, T. D. A. Cockerell. Abbey Wood, May 1894, A. S. Poore. A cornucopia-shaped specimen is recorded by Dr. Turton as found at Dartford by Mr. Swainson.

Oxford—Mr. Whiteaves records a specimen found at Summertown, which is now in the museum; and Mr. Collinge reports a scalariform shell from near Doddington.

Cambridge—A subscleriform example, with diameter of 21 mill. and altitude of 25 mill., in garden, Cambridge, Hugh Watson.

Gloucester W.—Arbutus Walk, Blaise Castle Wood, near Henbury, Bristol, and now in the British Museum, S. G. Perceval. Miss F. M. Hele has also found two specimens near Bristol, approaching the cornucopia form.

Hereford—A very perfect scalariform shell from Ross, W. C. Blake.

Pembroke—South Cliff, Tenby, 1895! A. G. Stubbs.

Norfolk E.—Cromer, July 1883! Rev. Dr. McMurtrie.



FIG. 325.—*Helix aspersa* m. *cornucopiæ* Gmel. (Falmouth).

Lincoln N.—A dead shell amongst *Vinca minor* at Bottesford, 1865, Rev. E. A. Woodruffe-Peacock.

Lancashire Mid—The Cove, Silverdale, R. Standen.

Isle of Man—Douglas road, Peel, Aug. 1892, W. Moss.

SCOTLAND.

Renfrew—Old wall, Crawford street, Greenock ! T. Scott.

CONTINENTAL DISTRIBUTION.

France—Dr. Grateloup cites Southern and Western France as regions where this form has been found, and especially mentions Bordeaux in the Gironde, and Toulouse, Haute Garonne, as localities. In Finistère, Bourguignat records Quimper as a locality ; and Dautzenberg cites an example from Kervallon near Brest. In the Pas-de-Calais, Bouchard-Chantreaux records it from gardens in Boulogne. Régelsperger states it to be very rare about Rochelle, Royan, etc., Charente Inférieure. Dubrueil found it rather frequent about Montpellier, Hérault. Taslé quotes Bois de Larmor near Vannes, Morbihan ; Mouton the environs of Grasse, Alpes Maritimes. Cailliand the vicinity of Nantes, Loire Inférieure ; Thorent gives Narbonne, Aude ; Locard records it as var. *scalaria* as rare about Lyons ; Clement for Villevieille, Gard ; and Dr. Gassies cites two specimens from near Nerae, Lot-et-Garonne, and also enumerates var. *scalaria* and *subscalaria* for the Agenais.

Spain—Zulueta records a cornucopial form as found in Oct. 1904 at Foutroubat in the inner convent garden, Montserrat.

Algeria—Rare about Algiers, according to Lallemant.

Geographical Distribution.—*Helix aspersa* is naturally a western species in Europe, but has extended its range in the south, until it has become perfectly circum-Mediterranean in its distribution.



▨ Probable Range.

■ Recorded Distribution.

FIG. 326.—Geographical Distribution of *Helix aspersa* Müller.

Eastwardly in Central Europe, its range is sharply delimited, probably owing to the prevalence of *Helix pomatia* in that direction, a species which is closely allied to *H. aspersa* and a probable competitor ; each species is, however, gradually encroaching on the territory of the other. In Venetia, where both species are found, *H. aspersa* lives on the lower and marshy ground, while the middle and upper regions are inhabited by *H. pomatia*.

Along the Mediterranean littoral, where it is in competition with a comparatively weaker fauna, it has spread rapidly, is very common, and grows to a large size; Greece, Algeria, Spain, certain parts of Southern France and Palestine being especially noted for the immense shells found in those countries.

It is a species almost unknown east of the Rhine, being practically absent from Germany, Denmark, Scandinavia, and Northern Russia, and only occasionally recorded as picked up in or near isolated gardens.

In the British Isles it is diffused throughout England, Ireland and Wales, but in Scotland is not known from the extreme north or from the Orkneys and Shetlands, though inhabiting the Hebrides.

It is exceedingly plentiful and almost ubiquitous in the south, becoming scarcer and more local towards the north, and on the mainland attaining the limits of its northern range in the county of Elgin, its further extension being apparently retarded by the line of the Caledonian Canal, beyond which it has as yet only been found at Ardtornish Castle, Argyllshire.

Being one of our most highly organized and dominant species, it is not surprising to find that almost wherever introduced it has maintained its footing and increased in numbers to the detriment of the weaker native species with which it may come in competition.

Thus, it is now found in Australia, Tasmania, and New Zealand, where it is rapidly becoming plentiful. In numerous localities in North, South, and Central America it is also firmly established, and is also found in Cape Colony, St. Helena, Mauritius, Seychelles, Haiti, and numerous other places.

GERMANY.

This species has scarcely yet naturally extended its range into the country, excepting possibly Alsace and Baden, but has been artificially introduced into several districts.

Borcherding cites it as an introduced species in the gardens of North-west Germany between the Ems and the Elbe; and Dr. Pfeiffer ascribes the specimens living in the castle gardens at Merseburg to a similar origin.

In Lorraine, the specimens found in the botanical garden at Metz are regarded by Puton as descendants from those imported from Dauphiny for the snailery established by the Carthusian monks at Metz; it has also been reported from Strasburg, but the record has been regarded as erroneous, or referring to artificially introduced examples.

In Alsace, it is recorded by Puton from Hagenau on the banks of the Rhine; Morlet has found specimens by the Rhine and near Colmar; and Gysser reports it from Baden at Meersburg on Lake Constance.

FRANCE.

Diffused over a great part of the country, apparently more particularly affecting the coast departments, and judging by the great dearth of records it is apparently rare or absent from the interior of the country.

It has been recorded from Ain, Aisne, Alpes Maritimes, Aquitaine, Ariège, Ardèche, Ardennes, Aube, Aude, Auvergne, Basses Alpes, Basses Pyrénées, Bouches du Rhône, Calvados, Cantal, Champagne Meridionale, Charente, Charente Inférieure, Côte d'Or, Côtes du Nord, Creuze, Deux Sevres, Dordogne, Doubs, Drôme, Eure, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Marne, Hautes Pyrénées, Haute Savoie, Hérault, Ile-et-Vilaine, Isère, Jura, Landes, Loire Inférieure, Lot-et-Garonne, Lozère, Maine-et-Loire, Manche, Meurthe et Moselle, Meuse, Moselle, Morbihan, Nièvre, Nord, Oise, Orne, Pas-de-Calais, Pyrénées Orientales, Rhône, Saône-et-Loire, Sarthe, Savoy, Seine, Seine Inférieure, Seine-et-Marne, Seine-et-Oise, Somme, Var, Vaucluse, Vendée, Vienne, Yonne, and Isle of Corsica.

Distribution of *Helix aspersa* Müller

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilts N.	48 Merioneth
8 Wilts S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid
21 Middlesex	HUMBER
22 Berks.	61 S.E. York
23 Oxford	62 N.E. York
24 Bucks.	63 S.W. York
ANGLIA	64 Mid W. York
25 Suffolk E.	65 N.W. York
26 Suffolk W.	TENE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Hants.	69 Westmorland
32 Northampton	and L. Lancs.
SEVERN	70 Cumberland
33 Gloucester E.	71 Isle of Man
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easternness
76 Renfrew	W. HIGHLANDS
77 Ladbark	97 Westernness
E. LOWLANDS	98 Main Argyile
78 Peebles	99 Dunbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	X. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Pth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

- Probable Range.
- Recorded Distribution.
- Distribution verified by the Author.
- Geological Distribution.

NETHERLANDS.

Belgium—Recorded from the provinces of Antwerp, Brabant, East and West Flanders, Liege, and Limburg.

Holland—Only known as yet from Zeeland, Utrecht, and South Holland.

ITALY.

Probably diffused over the whole peninsula. It is actually on record from Abruzzi, Calabria, Campania, Emilia, Liguria, Lombardy, Marches, Piedmont, Rome, Tuscany, Umbria, Venetia, and the neighbouring Islands of Capri, Elba, Lampedusa, Malta, Pelagosa, Sardinia, and Sicily.

SPAIN AND PORTUGAL.

Spain—Distributed all through the maritime provinces, but apparently absent from the interior of the country. It has been reported from the Basque provinces, Old Castile, Asturias, Galicia, Andalusia, Murcia, Valencia, Aragon, Catalonia, and the Islands of Majorca, Minorca, and Ivia.

Portugal—Probably dispersed throughout the country, but records are only known from Minho, Beira, Estremadura, and Tras os Montes.

BALKAN PENINSULA.

Greece—Apparently dispersed in suitable localities throughout the country, and sometimes attaining a large size. It has been recorded from Epirus, Thessaly, Morea, and the vicinity of Athens, as well as from Corfu, Cerigo, Cephalonia, and Zante among the Ionian Islands; Tinos, Syra, and Eubœa in the Grecian Archipelago; and on Mont Skloka, near Canea, in Crete.

European Turkey—Dr. von Martens reports it from Constantinople on the authority of Roth.

AUSTRO-HUNGARY.

Only known from the southern parts of the empire, as Carniola, Croatia, Dalmatia, Goritz, Illyria, Istria, and South Tyrol.

SWITZERLAND.

H. aspersa is not a native of this country, but has been naturalized about Berne, Lausanne, Devens, Bex, and probably other places. Charpentier and Jurine also cited Geneva, but Dumont and Mortillet regard this as erroneous.

SCANDINAVIA.

Norway—One specimen found by Mrs. H. Crowther, of Leeds, in July 1901 at Nordheimsund near Bergen.

Sweden—Mr. J. H. Ponsonby informed me in 1882 that he had in his possession a Swedish specimen.

RUSSIA.

Recorded for Odessa and Kherson in the government of Kherson by Dr. H. Jordan.

NORTH AFRICA AND ASIA MINOR.

Helix aspersa appears to be dispersed along the whole North African seaboard.

Morocco—Found throughout the north and centre of the country and is specially quoted from Tangier and from the island which forms the port of Mogador.

Algeria—Common and usually much larger and more ventricose than in France. It is found on the Plain of Angade on the Moroccan frontier; by the Dolmen of Guyotville on the Plateau of Beni Messons; in the environs of Oran, Tlemcen, Cherchell, Mostaghanem, Algiers, Koleah, Blidah, Medjez-Amar, Amar, Bougie, Bône, Constantine, etc.

In Kabylia it prefers the hills, sheltered from the west winds, and about Boghar lives on the trunks of the green oak and in the pine forest of Alep, etc.

The var. *rugulosa* is confined to the coast.

Tunis—Very abundant about Tunis, about the ruins of Utica, Carthage, Oudena, etc. In Medjerda Valley magnificent shells are found. In Ain-Draham and Fedj-Saha in Kroumirie the shells resemble *H. mazzullii* of Jan,

Tripoli—Dr. E. von Martens cites Benghazi; and von Barry reports small specimens from Gharian in Tarhuna Mountains.

Egypt—Specimens in the British Museum labelled from Egypt; Schmidt records it as found as far as the Nile cataracts; Mr. Gude reports it from Ramleh; and Mr. J. H. Ponsonby from Alexandria.

Asia Minor—It is recorded by Férussac for Syria; and by Canon Tristram as very common in gardens at Tyre, Sidon, Beyrout, Jaffa, and other places on the coast of Palestine, frequently reaching a very large size (Faun. and Flor. Palestine, 1885, p. 187).

Dr. Kobelt records it for Caria, Lycia, and Cilicia; Herr Clessin records a thin, dark yellow form of medium size with two or three bands from Adalia in Karaman; Dr. Retowski found it abundantly and very constant in form and banding at Sinope in Kastamuni; Mr. G. K. Gude has specimens from Trebizond; Mr. Bliss has collected it on the ruins of Magnesia ad Mæandrum and Priene near Smyrna in Aidin; and Dr. Kobelt cites it from the Islands of Cyprus, Rhodes, Leros, and Kalymnos.

ATLANTIC ISLES.

Azores—Horta, Fayal Island, 1890-1 (Dr. W. H. Rush, *Nautilus*, 1891, p. 51). S. Miguel (Hochstetter, f. Dr. von Martens).

Madeira—Lives only in a garden at Funchal, but was originally brought from Lisbon (R. B. Watson, *Journ. de Conch.*, 1876).

Canary Isles—Grand Canary, Lieut.-Col. Parry. The commonest shell on the island of La Palma, 1906, W. J. Farrer.

St. Helena—Introduced from Europe, T. V. Wollaston.

ETHIOPIAN REGION.

Cape Colony—Introduced at Cape Town by M. M. Dastre, who scattered half a caskful of young specimens obtained from the captain of a small war vessel (E. L. Layard, *The Field*, Jan. 11, 1879). On the Cape Peninsula it is abundant at Three Anchor Bay, Aug. 1905! W. Denison Roebuck; and at Simon's Bay and Sea Point, Hugh Watson. Very abundant and destructive in gardens about Port Elizabeth F. W. Wotton, Nov. 1892. Port Elizabeth and Cape Town (Melvill and Ponsonby, *Proc. Mal. Soc.*, 1898, p. 184).

Mauritius—Found in "Plaines Wilhelms," and, if I remember right, near Vacos, not far from Tamarind Falls in the Moka district (Pike's *Subtropical Rambles*, 1873, p. 213).

Seychelles—Dr. E. von Martens, *Ins. Maur. und Seych.*, 1880, p. 196.

NEARCTIC REGION.

Canada—Nova Scotia (Binney and Bland, *op. cit.*).

New York—Collected by Dr. Howard N. Lyon in April 1882 near Owasco Lake, Cayuga co. (F. C. Baker, *Nautilus*, 1899, p. 57).

Maine—Portland (Binney and Bland, *Land and Freshwater Shells of N. Amer.*, 1869, p. 183).

Massachusetts—Specimens from Ireland were liberated at Wood's Holl in Aug. 1883 by Messrs. E. A. Andrews and B. F. Koons (*Bull. U.S. Fish Comm.*, iv., p. 87).

South Carolina—In gardens, Charlestown (Binney and Bland, *op. cit.*). St. Peter's churchyard, Logan street, Charlestown (W. G. Mazyek, *Proc. Ac. Nat. Sci. Philad.*, 1876, p. 127). Plentiful in St. Michael's churchyard in 1875 (W. G. Binney, *Man. Amer. Land Shells*, 1885, p. 470).

Louisiana—New Orleans and Baton Rouge (W. G. Binney, *op. cit.*).

California—Introduced forty years ago to the vineyards on the west bank of river Guadalupe in Santa Clara Valley by Mr. Delmas, and according to Mrs. Bush is extending its range. Mr. Delmas also liberated colonies at San Francisco and Los Angeles, and a small colony was established many years ago at San José (J. Keep, *Nautilus*, Sept. 1899, p. 60). Occurs in gardens, etc., around Oakland, and Prof. Keep found a fine specimen at Pacific Grove, Monterey. Not uncommon in East Side Park, and is also reported from Elysian Park, Los Angeles, possibly the descendants of the Delmas colony.

NEOTROPICAL REGION.

Chili—In gardens, Santiago; and Valparaiso, Mrs. McKenny Hughes.

Brazil—Specimens in the British Museum, labelled "Brazil," Sept. 1886! Prince Maximilian von Wied found a small distinct variety in Brazil, according to Pfeiffer (Deutsch. Moll., 1828, p. 15), and Mrs. McKenny Hughes reports specimens from Rio de Janeiro.

Uruguay—It is found sporadically for twenty miles around Monte Video! and perhaps even further, Lionel E. Adams, Jan. 1908.

Argentine—M. Strobel records this species for Buenos Ayres, and observes that the shell has undergone modification, being more fragile and delicate than individuals from Spain or Africa. Dr. Rush reports it from the British Cemetery at Buenos Ayres (Nautilus, Nov. 1896, p. 78).

French Guiana—Recorded from the forests of Cayenne by Férussac in 1822, and still existing in the country; a specimen in the collection of Mr. J. H. Ponsoby has the usual band formula 1(23)45.

Mexico—Mr. W. Cash, in August 1899, found the species abundant around the city of Mexico, and on the trunks of trees at Chapultepec, places over 7,000 feet above sea level. He also found it commonly in gardens near and around the site of the palace of Cortez, at Cuernavaca, at an altitude of about 4,000 feet.

Mr. H. A. Pilsbry has also recorded it as plentiful about the city of Mexico, and especially in the park at Chapultepec; specimens are also in the National Museum, Washington, from Puebla.

Haiti—Recorded by Férussac in 1822 from Hispaniola. The shells now found there are thinner than usual, and as they show other differences from the typical form, have been distinguished as var. *haitiensis*.

Ecuador—The base of Chimborazo (Férussac, l.c.).

AUSTRALASIAN REGION.

South Australia—Gardens in suburbs of Adelaide, and rapidly spreading, W. T. Bednall, July 1884. Abundant in the Botanical Gardens, Adelaide, Dec. 1904! W. Denison Roebuck.

New South Wales—Mr. Brazier cites Dubbo and Coonamble for this species. Mr. C. T. Musson remarks that the New South Wales shells are chiefly the var. *tenuior*, and that it is very common about Sydney, as at Elizabeth Bay and Double Bay. Dr. J. Cox once found an interesting turriculate specimen in his garden, north shore, Sydney. Plentiful in gardens at Bulli! and at Mosman's Bay, April 1905! W. Denison Roebuck.

Victoria—Plentiful about Melbourne (Petterd, Monog. Tasm. Land Shells, 1879). Swarming in gardens, Geelong and East Prahran, Dec. 1904! W. Denison Roebuck.

Tasmania—Lieut. Beddome placed some living specimens on his estate at Queenborough near Hobart (Petterd, Monog. Tasm. Land Shells, 1879, p. 43). Common near towns on the coast (Musson, Proc. Linn. Soc. N.S.W., 1890, p. 894).

New Zealand—In the North Island, it is common at most of the seaport towns; but is exceptionally thin at Apua in the Bay of Islands, while at Auckland the shells belong to the var. *conoidea* (C. T. Musson, Proc. Linn. Soc. N.S.W., 1890, p. 894). Mr. H. B. Preston first noticed it in gardens at Wellington, and afterwards at Paikakariki, about twenty-seven miles to the north, but it is not known at Otaki, twenty miles further north, though plentiful at Palmerston, about forty miles from Otaki. Although plentiful in certain districts, it does not appear to spread very rapidly (Sci. Goss., 1894, p. 139). Very plentiful and destructive in Mr. Murdoch's garden, St. John's Hill, Wanganui, Feb. 1905! W. Denison Roebuck.

In the South Island, it is quite a pest about Nelson, J. Ritchie, jun., Oct. 1885. Very plentiful at Christchurch, Jan. 1905! W. Denison Roebuck. Greymouth, T. Taylor (Journ. of Conch., Jan. 1906, p. 273).

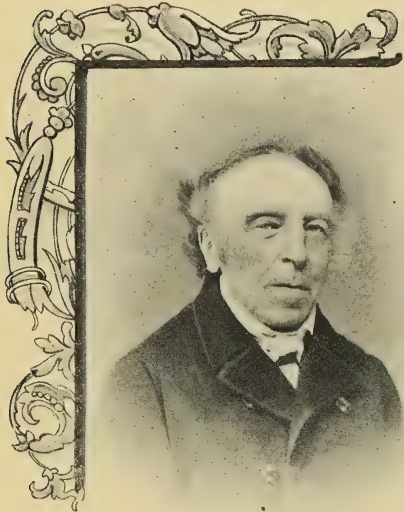
New Caledonia—Noumea, introduced by M. Lugnier (E. L. Layard, The Field, Jan. 11, 1879).

Loyalty Islands—Mr. E. L. Layard records the first finding of the shell on the islands in 1879, and traced its introduction to the officers of a French war vessel. Numerous specimens were collected by Mr. Hadfield, mostly differing but slightly from European specimens, but several were almost uniformly black.

Norfolk Island—Pale fawn coloured specimens with typical banding! F. H. Sikes.

SUB-GENUS *Cepæa* Held.***Helix nemoralis* Linné.**

- 1667 *Cochlea vulgaris testa variegata* Merret, Pinax, p. 207.
 1674 *Cochlea vulgaris et colore et fasciis multa varietate ludens* Lister, Phil. Trans., vol. ix., no. 105, p. 99.
 1678 *Cochlea citrina aut leucophæa non rarò unicolor, interdum tamen unica, interdum etiam duabus, aut tribus, aut quatuor, plerumq; verò quinis Fasciis pullis distincta* Lister, An. Angl., Tit. iii., p. 116, tab. 2, f. 3.
 1702 *Cochlea terrestris vulgarissima variegata* Petiver, Gazoph., tab. 91, ff. 9-12, and tab. 92, ff. 9, 10.
 1741 *Cochlea vulgaris, testa variegata* Linnaeus, Iter Oeland, p. 127.
 1746 *Cochlea testa utrinque convexa flava; fascia subsolitaria fusca, labro reflexo* Linnaeus, Fauna Suec., i., p. 370, no. 1294; ii., no. 2186.
 1758 *Helix nemoralis* Linné, Syst. Nat., ed. x., vol. i., p. 773, no. 604.
 1817 — *tutorum* Stewart, Elem. Nat. Hist., vol. ii., p. 413.
 1825 — *cincta* and *quinquefasciata* Sheppard, Linn. Trans., xiv., p. 163.
 1875 — (*Pentatænia*) *tonnensis* Sandberger, Vorwelt, p. 927, pl. 35, f. 38.
 1778 *Cochlea fasciata* Da Costa, Test. Brit., p. 76, pl. v., ff. 1-3, 8, 19.
 1797 — *versicolor* Humphreys, Mus. Calonn.
 1826 *Helicogena nemoralis* Risso, Hist. Nat. Alp. Marit., p. 160, no. 130.
 1837 *Cepæa nemoralis* Held, Isis, p. 910.
 1852 *Tachea nemoralis* Leach, Synopsis, p. 61.



HISTORY.—*H. nemoralis* (*nemoralis*, inhabiting woods) was first noted in this country by Merret in 1667, who enumerates it as British under a polynomial designation.

This species, which is typical of the Pentatæniate *Helices* and strongly displays the varied fasciation characteristic of the group, is associated with the late Herr Georg von Martens, who in 1832 discussed the mode of banding in the group, and showed that the different variations are those of number only, all referable to five normal bands, which are invariable in position, and devised the formula by which the various band arrangements can be readily indicated.

Some uncertainty has always existed as to the precise species which Linné intended to indicate by the name *nemoralis*, and Dr. Westerlund

has expressed the view that Linné's original diagnosis (1741), though not defining the colour of the lip, was based on the form known under the name of *H. hortensis*, because *Helix nemoralis* does not exist in Oeland; yet as *H. hortensis* was formerly and is even at the present day still regarded by some as specifically identical with *nemoralis*, the action of Müller in being the first author to separate the two forms as distinct species entitle his views to adoption.

George A. Sowerby

Diagnosis.—*Helix nemoralis* may be distinguished from *H. hortensis* by its larger, thicker, and more depressed shell, which usually possesses half-a-whorl more than its ally; the surface is also less glossy; and the lip and callous deposit on the penultimate whorl are stronger and of a permanent brown or black, differing in this from the dark-lipped form of *H. hortensis*, in which species the dark pigmentation of the lip gradually fades on exposure to light. The disposition of the bands is also different, as they are placed somewhat lower on the shell, the basal bands thus encircling the umbilical region more closely, and approximating in this respect to *Helix austriaca*.

INTERNALLY, the gypsobelum or love-dart is an undeniable and unfailing criterion of their specific difference, the dart of the present species differing strikingly from the dart of its ally and closely resembling that of *H. aspersa*, while the dart of *H. hortensis* is of quite a different type, having most affinity with that of *H. pisana*. The vaginal mucus-glands are also perceptibly different, those of *H. nemoralis* being usually less ramose with the digitations quite uniformly cylindrical throughout; while those of *Helix hortensis* have more numerous digitations and are also irregularly tumid towards the extremities.

Description.—The ANIMAL is of moderate bulk, usually of a leaden-grey, with a yellowish or greenish tinge, becoming darker with age; the surface is noticeably tuberculate, with a pair of longitudinal furrows along the centre of the back, which contain a row of elongate and usually paler TUBERCLES, rendered more perceptible by the darker shade of the subdorsal area; the LATERAL GROOVES are present and quite perceptible; MANTLE usually pale yellow, studded along the free margin by the pigment glands which are similarly arranged to the banding characterizing the shell; TENTACLES long, rather slender, tapering, and divergent, nearly cylindrical, with well-marked bulbous extremities, very delicately tuberculate; lower tentacles short and cylindrical.

SHELL subglobose, very convex above and less so beneath; with very fine but irregular striæ of growth, and delicate spiral lineation, which gives to aged shells a somewhat malleate aspect; thin, rather solid, subopaque, smooth, and somewhat glossy, typically yellow, with five narrow dark-brown spiral bands, but varying to white, red, fawn, brown, or even to lilac, with one to five bands, which are occasionally confluent or interrupted, and assume a great variety of colouring, or may be perfectly colourless and transparent. SPIRE, five-and-a-half regularly increasing convex WHORLS; SUTURE not deep; APEX raised; APERTURE very oblique, deeply crescentic, and interrupted by the penultimate whorl; PERISTOME interrupted and slightly reflected, the OUTER LIP noticeably inflected above, but slightly angular below, bending abruptly towards the columellar margin, usually brown-black (though varying to many diverse tints) with a submarginal rib of the same colour: inner lip tinged with the colour characterizing the outer lip; UMBILICUS open and deep in the young, but becoming closed in adult life.

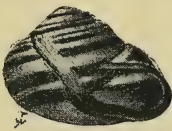


FIG. 328.

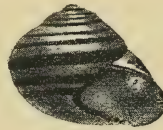


FIG. 329.

FIG. 328.—*Helix nemoralis* L., showing typical form and banding.

FIG. 329.—*Helix nemoralis* L., showing *in situ* the thin, iridescent, summer epiphragm, and the white calcareous thickening in front of the respiratory orifice.

Diam. 20 mill.; alt. 15 mill.; average weight about 10 grains, and the thickness of the shell towards the aperture is between one-third and one-tenth of a millimetre.

The summer EPIPHRAGM is quite flat, smooth, thin, transparent, and glistening, with an opaque and calcified area nearly opposite the respiratory orifice, but the hiberna one is usually thick, opaque, and somewhat cretaceous, with one or more thinner films behind, separated from each other by a perceptible space.

The REPRODUCTIVE ORGANS are of the same general character as in the other species of the restricted group; the OVOTESTIS is imbedded in the digestive gland quite at the apex of the shell; the long dull yellowish-white HERMAPHRODITE DUCT is simple and slender at its origin and at its junction with the large VESICULA SEMINALIS; the voluminous intermediate tract is compactly convoluted; the ALBUMEN GLAND is ample, large and yellow, or greenish-amber in colour; the sacculate and ample OVIDUCT is reddish-buff, and the PROSTATE or sperm duct is follicular in structure; FREE OVIDUCT and VAGINA purplish-brown; SPERMATHECA of a reddish flesh colour, borne on an exceedingly long and dark-brown duct, which shows a nascent caecal diverticulum towards the free-end, where it becomes of a pinkish-brown; the VAS DEFERENS joins the deeply-pigmented male organ at the base of the long and slender dark-brown FLAGELLUM; the EPIPHALLUS is short and is continuous externally with the purple-black PENIS SHEATH, which gradually enlarges, but contracts somewhat abruptly before its entry into the ATRIUM, the retractor muscle indicating the limits of the eversible portion of the organ; the paired MUCUS GLANDS are nine to twelve mill. long, placed as usual on the free oviduct above the dart sac or stylophore, and each of which divides early into two or more slender, nearly cylindrical whitish caeca, and though the whole number may vary between three and nine, the most usual arrangement in this country is three digitations on one side and two on the other; the STYLOPHORE or dart-sac is simple and subclavate in form, white in colour in adolescence and before secretion of the dart, becoming of a dull livid bluish-grey when adult; the thick outer envelope is usually greyish-white, tinged with a warmer shade, the livid aspect of the organ being probably due to the densely-pigmented inner coating and to the general darkening of the organs at sexual maturity.

The GYPSOBELUM or love dart, which is slightly plastic when first removed from the sac, is seven to eight mill. in length, straight, but with its maximum breadth about the middle, and furnished with four sharp slightly transparent longitudinal blades, of which two are more prominent than the opposite pair, and are connected together transversely by a variable number of somewhat transparent crescentic films, which usually disappear on a short exposure to a heated solution of caustic potash; the base is conically expanded and surrounded by an annulus composed of sixteen to eighteen longitudinal rods around a purple core.

The SPERMATOPHORE, which is secreted within the flagellum and epiphallus, is a slender filament, thirty to forty mill. long, with an enlarged and hollow but soft-walled anterior median portion, distended by a whitish

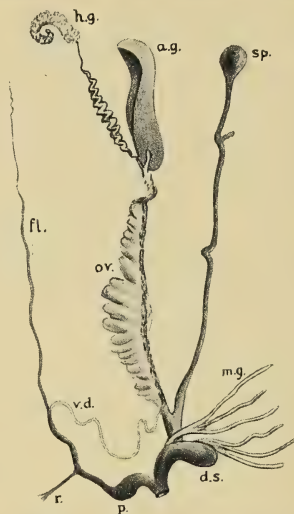


FIG. 330.—Reproductive organs of *Helix nemoralis* Linné.

a.g. albumen gland; d.s. dart sac or stylophore; fl. flagellum; h.g. ovotestis or hermaphrodite gland; m.g. vaginal mucus glands; ov. oviduct; p. penis sheath; sp. spermatheca; r. penis retractor; v.d. vas deferens.



FIG. 331.

FIG. 331.—Immature Gypsobelum or Love-dart of *Helix nemoralis* Linné, before the development of the transverse septa, $\times 4$.

FIG. 332.—Mature Gypsobelum or Love-dart, bearing fully-developed blades and septa, $\times 4$, with diagrammatic sections showing its structure.

FIG. 333.—Base or "Krone" of the dart. $\times 6$.

FIG. 334.—Section through base of Stylophore or Dart-sac, showing its various layers and the papilla upon which the dart rests, $\times 6$.



FIG. 332.



FIG. 333.



FIG. 334.

spermatic fluid, quickly turning yellowish on exposure. The filament is covered with fine longitudinal striæ and furnished with four sharp but thin and transparent longitudinal ridges, which are least developed on the enlarged tract; the slender posterior filament is twisted similarly to the free end of the flagellum.

The ALIMENTARY SYSTEM is of the ordinary triodromous type, with three intestinal tracts; the paired SALIVARY GLANDS are ample, of a white colour, and lobular, and about twelve millimetres long, adherent to and surrounding the crop, with elongate and slender ducts which are about the same length as the glands and debouch into the rear upper part of the mouth cavity; the ŒSOPHAGUS and CROP are striped longitudinally with darker lines; the STOMACH is placed at the end of the ingestive tract and is a gradually enlarging receptacle, but terminates more abruptly behind, where the biliary ducts enter; the RECTUM is long, slender, and direct, terminating as usual close by the respiratory orifice.



FIG. 335.—
Alimentary organs of
Helix nemoralis L.,
× 3.
bb. buccal bulb; s.g.
salivary glands; st.
stomach; r. rectum.

The PEDAL GLAND very compact and well developed. Longitudinal groove deep. The roof of canal with two rather long folds; the epithelium of channel very short.

The MANDIBLE or jaw is about two mill. or more from side to side, reddish-fawn in colour, shading to deep brown in the thicker and more solid parts, convex from the front backwards, very broadly crescentic, with somewhat truncated and slightly attenuated and rounded ends, bearing from two to nine widely-separated but more or less prominent vertical ribs, but usually there are about five only; the central rib is, however, usually insignificant, the admedian ribs being much more distinct and prominent, and strongly denticulating both margins, while frequently the others only crenulate the cutting edge, becoming obsolete and disappearing before reaching the upper margin, but all are grouped near the median part and increase in number with age. The striæ or lines of growth are very delicate.



FIG. 336.—Jaw or Mandible
of *Helix nemoralis* L., × 8.
(Christchurch, Hants.).

Mr. H. Crowther has remarked that the character of the jaw is influenced by the environment; as when the animal lives in exposed positions by dusty roadsides on carboniferous formations the jaw is always stronger, darker, and bears more numerous and thicker ribs, whereas when living in moist localities and feeding upon succulent herbage, the jaw is thin and the ribs fewer and more delicate.

The RADULA is of the usual oblong shape, about five mill. in length and nearly two mill. in breadth, composed of about 140 flexuous transverse rows, each row containing about 89 teeth, and constituted by a median series of strong unicuspid teeth, flanked by about fourteen laterals, each bearing a powerful central cusp or mesocone, while a distinct though comparatively small ectocone becomes gradually



FIG. 337.—Representative denticles from half a transverse row of teeth of *Helix nemoralis* L. (highly magnified). The numerals above the teeth indicate their position in the transverse row.

developed as the teeth recede from the centre of the radula; the marginals, which are preceded by a number of transitional teeth, gradually broaden and become strongly and distinctly quadricuspidate, by the splitting of the mesocone and the increased development and bifurcation of the ectocone, the outermost denticles regularly dwindling in size and the extreme marginal being minute and simple.

The formula of a Plumstead specimen prepared by Mr. J. E. Cooper was

$$\frac{30}{2 \cdot 4} + \frac{14}{1 \cdot 2} + \frac{1}{1} + \frac{14}{1 \cdot 2} + \frac{30}{2 \cdot 4} \times 140 = 12,460 \text{ teeth.}$$

Reproduction and Development.—Little or nothing is known of the details of the conjugation of this species, or of its amorous preludes, but it is probable that similar preliminary caresses and blandishments take place as described under the preceding species; congress, however, must take place with great facility, as frequently some of the captures are found paired in the collecting-box at the close of a day's excursion, and this union will frequently continue for an entire day.

The colouring of *Helix nemoralis* is regarded by Dr. Beddard as being either Sematic and warning, or Epigamic and sexually signalling in character, although, probably from an imperfect acquaintance with terrestrial mollusca, he objects to the use of the term Epigamic in connection with snails on account of their hermaphrodite structure; but Dr. Gain, who has had much experience in breeding mollusks, records that he has found that individuals kept in confinement evinced a marked preference for mating with others of similar colour and markings to themselves.

The eggs are laid, it is believed, a few days after conjugation, although Schumann definitely states that the gestation extends over a period of twenty-eight days. They are rounded-oval in shape, three mill. long by two-and-a-half mill. in diameter, resembling fowls' eggs in miniature, pure white or yellowish-white in colour, calcareous, opaque, hard, and brittle, and usually fifty to eighty in number. They are deposited in clusters in holes excavated by the mother snail at the roots of grass or other vegetation, the foot of walls, etc., and hatch in fifteen to twenty days, the young usually becoming adult early in the following year.

Each particular phase of variation in this species tends to breed true, and this is shown not only by the results of the artificial breeding of the various varieties, but by the observed fact that particular colours or bandings usually preponderate in isolated localities, similar conditions inducing a general likeness of the associated shells, although Dr. Arndt has declared as a result of his many experiments that only half the offspring of either banded or unicolorous parents resemble their progenitors, the other moiety being variously banded, and that even continued interbreeding of identical variations never results in more than seventy-seven per cent. of the progeny agreeing with their parents and grand-parents.

Dr. W. A. Gain, however, who formerly experimented extensively in breeding with this species, found that the progeny of banded or unbanded forms invariably resembled the parents, breeding quite as true as the various races of domestic poultry.

M. Baudelot also declares that the young of bandless or banded shells are always similar to their parents, excepting only those with the formula 00300, which he avers yield banded and unbanded shells indifferently.

Dr. Arnold Lang also found that the banding was generally faithfully transmitted, but that there was a tendency for the bandings 00300 and 12345 to appear amongst the progeny of unicolorous parents, but all these various irregularities may probably be explicable as atavic and due to the influence of more or less remote progenitors on the Galtonian hypothesis.

Uses.—*Helix nemoralis* is used as food in many parts of Europe, and about Namur in Belgium and in certain parts of France is preferred to *Helix pomatia* or *H. aspersa*, being considered more delicate.

As medicine, it at one time occupied a position in the *Materia Medica*, and was the base of certain pharmaceutical preparations.

For ornament, the shells are utilized by the peasantry and children at Bundoran, Ireland, and certain other Irish and British seaside resorts, where they are strung together to form necklaces, which are sold to

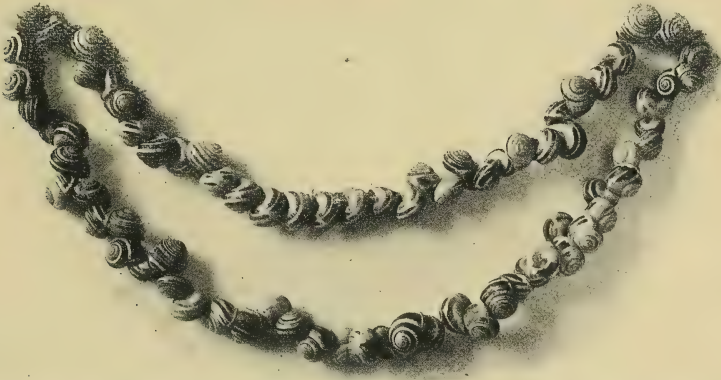


FIG. 338.—Helicidian necklace, made by the peasantry of Donegal, and composed solely of *Helix nemoralis*, reduced to one-fourth natural size (Mr. R. Welch's collection).

tourists and visitors. Necklaces of this kind are, according to Mr. R. Welch, a survival of a prehistoric personal ornamentation, as is evidenced by their presence in ancient Irish interments.

Habits and Habitats.—*Helix nemoralis* is regarded as a somewhat slow and sluggish animal, but moderately sensitive, and in crawling carries its shell obliquely inclined, but its rate of progress is far from uniform, as I have counted in the same specimen during progression 36, 42, and 50 undulatory waves per minute. It lives by preference along hedgebanks, amongst bushes and against walls, especially if overgrown with ivy or with gorse, heather, brambles, foxgloves, nettles, or other vegetation, but also favours gardens, fields, vineyards, and the margins of woods and plantations.

It seems to be more plentiful on limestone soils, and is often especially common among the débris of limestone crags or in quarries, but is also common on open downs, amongst furze, juniper bushes, and long grass.

Roadsides are also much frequented, perhaps on account of the variety of herbage, the abundance of finely comminuted limestone particles, and the greater scarcity of helicivorous birds, probably scared away by the traffic.

It frequently swarms on the sandhills of our coasts, and in such circumstances may be associated with *H. itala*, which also flourishes on dry and arid slopes, but when living within or near high-water mark the epidermis is invariably lost and the shell becomes much weathered, white, and worn.

Though usually not living in company with *H. hortensis*—being really less montane in habit, and showing a greater capacity for prospering under other and more arid conditions, yet there are many undoubted instances of their living in company, sometimes in approximately equal numbers. It is much more geophilous than its ally *H. hortensis*, not climbing trees so frequently nor ascending so high as that species, although the habit varies somewhat in different districts, as in some localities it is scarcely known to ascend trees, while in others it is a common habit.

It ascends to an altitude of about 4,000 feet in the Pyrenees; and in the Maritime Alps, near Menton, though not found in the submarine zone,

is common from the height of 1,500 feet [up to the very summit of the mountains at about 4,000 feet altitude, the shells at that height being thin and delicate, and the formula 00300 being predominant.

H. nemoralis is a light-loving creature, avoiding the dark recesses of dense woods and forests, yet it is crepuscular and nocturnal in habit, feeding during twilight or through the night, a habit due to the greater freedom from enemies at those times; it is, however, very susceptible to moisture, and though usually snugly secreted through the day and during drought, it emerges very quickly after showers or even before rain, so that in certain parts of France its appearance is regarded as a reliable indication of impending storms, the snail being said to crawl higher up the vine-supports for heavy and continued rain than for transient showers.



FIG. 339.—Slime track of *Helix nemoralis* L., about eighteen feet in length, as observed at Clifton, Derbyshire, by Mr. Lionel E. Adams.

Although the present species has not had the same attention devoted to its habits as *H. aspersa*, there is little doubt that it shares to some extent the same love of home, as displayed by usually returning for its diurnal siesta to the same shelter day after day, and this is confirmed by the track shown (f. 339) of the peregrinations of a specimen whose wanderings were traced by that careful and precise observer, Mr. Lionel E. Adams, and which also shows the peculiar crossing of the outward path on the homeward journey that has been so often remarked as characterizing those tracks.

During periods of dry summer weather, the siesta is prolonged, and the animal æstivates or remains torpid during its continuance, and it is on record that one specimen revived after being $3\frac{1}{4}$ years in a dormant condition.

In autumn, it usually retires early for hibernation, but is not a social hibernant, like *Helix aspersa*, although occasionally a number may be found congregated in some suitable and commodious shelter; but each individual ensconces itself amongst rubbish in hedge-bottoms, in crevices of walls or rocks, or buries its shell in the ground with the mouth upwards and level with the surface, forming a thick and slightly calcareous outer epiphragm at the mouth of the shell, and as the cold increases in intensity, shrinking further and further within the shell, and secreting at short intervals additional but thinner epiphragma.

It is also frequently found tenanted the hibernacula excavated chiefly by *Helix aspersa* in the carboniferous limestone cliffs, and doubtless will contribute to their perforation.

Though hibernating closely in severe weather, the animal often bursts its epiphragm in the milder intervals, and is also one of the first of the larger *Helices* to finally leave its winter quarters and resume active life, the immature animals always preceding the adults by a week or more.

As food, a great variety of plants are partaken of, but a few are especially sought for, the common stinging nettle (*Urtica dioica*) being a particular favourite both for food and shelter, while a single plant of the *Iris* has been noted at Leominster upon which seventy shells of *H. nemoralis* were observed. They will also devour cooked meat, and dead earthworms, insects, etc., and several were observed apparently feeding on the flowers of *Pinus insignis* at Morteboe, Devonshire, by Dr. G. B. Longstaff. *Myosotis* and *Lysimachia* have also been used as food upon which to rear the young. In captivity Dr. Gain offered this species 197 different kinds of food, but only one—the lettuce—was eaten with avidity though twenty-five other foods were eaten quite freely, but these were chiefly culinary vegetables and cultivated fruits, as gooseberries, peas, beans, cabbages, turnips, etc., and also the edible mushroom, *Boletus edulis*.

Parasites and Enemies.—The enemies of this species are numerous and destructive, and an incessant war is waged against it by many forms of life, which find it a nourishing and appreciated food, so that even any partial protection gained by acquiring a resemblance to other less appetizing or inanimate objects will be beneficial to the species.

Rats, field-mice, and voles all prey upon this species, and have been known to burrow into thick snow to obtain the hibernating *Helices* beneath, of whose presence they seemed to be aware. The hedgehog also devours numbers of these creatures, usually crunching up shell and animal together indiscriminately. The rabbit will feed upon this species, and has been actually observed feeding upon them at Magilligan Bay, Derry.



FIG. 340.

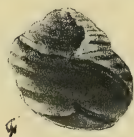


FIG. 341.

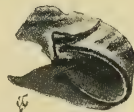


FIG. 342.

FIG. 340.—*Helix nemoralis* L., illustrating the manner in which they are destroyed by Field-Mice. Collected by Mr. C. E. Wright in an ironstone quarry at Lincoln.

FIGS. 341 and 342.—*Helix nemoralis* L., illustrating the manner in which these shells are broken by thrushes, etc. Collected by Mr. C. E. Wright, near Kettering.

Birds are especially destructive, thrushes and blackbirds feeding upon this species at all seasons, but especially during the winter months, when heaps of broken shells can be found around the various stones upon which they break the shells either by seizing them by the lip and striking them upon the stone or by fixing them in a convenient crevice and pecking at them until broken, like a nuthatch with nuts. Other birds doubtless assist in this great slaughter of the species, but little precise evidence is forthcoming.

The rapid disappearance or increasing rarity of this and allied species from the vicinity of the large manufacturing towns and industrial districts generally, has with some justice, been partially ascribed to the great increase in those areas, of thrushes, blackbirds, and other helicivorous birds, an increase due in great part to the "Bird Protection Acts."

At Charlestown, South Carolina, U.S.A., the formerly flourishing colony of this species has been practically exterminated and devoured by the predatory *Rumina decollata*, which is also an European introduction to North America.

Drilus, a coleopteron, allied to the glow-worm, and also its larva, attack and devour *H. nemoralis*, the larva taking up its abode in the shell of the victim, enclosing itself by a fibrous web before undergoing its metamorphoses. The beetle emerges in October.

The larvæ of *Lampyrus noctiluca*, the glow-worm, also feed on the living snail, and are believed by Fowler to derive their phosphorescent powers from this source.

The eggs even are not immune from attack, as ants, centipedes, etc., devour them whenever found, and mollusks of the same or other species will feed upon them, although their greatest enemies would appear to be dipterous larvæ, which frequently destroy whole broods.

Distomum leptostomum Olsson in its sexual mature state inhabits the intestinal canal of the hedgehog, but its miracidian, sporocyst, and cercarian (*Cercaria helici*s) stages are passed within the tissues, alimentary canal, and liver of *Helix nemoralis* and other common gastropods, the parasite gaining access to its later host, the hedgehog, when the snail is devoured. The caudal appendage of the young cercarium is occasionally retained to a later period, and then probably constitutes the *Distomum caudatum* of Loos. This species differs only in its smooth body surface and some slight internal modifications from *Distomum spinulosum*, known in its cercarian stage as *Cercaria spinulosa*, which has an identical life-history, but is characterized in the cercarian and sexual stages by its spinose body.

An Acarus or Mite (*Philodromus limacum* Jenyns) infests this and other species, and is very frequently seen nimbly running over the body of the animal. According to Réaumur, they often inhabit the intestinal canal, and take every opportunity to arrive there; but Dr. Jenyns considered their natural habitat to be the pulmonary cavity.

Klossia, a genus of *Gregarinidæ*, is parasitic within the enlarged epithelial kidney cells of this species, and in such position is filled with glycogen granules.

Osmia bicolor, a species of solitary bee, has been observed at Wotton-under-Edge, making its nidus within the shells of this species.

Geological Distribution.—*Helix nemoralis* is recorded as found in this country from the Coralline Crag up to the most modern deposits. On the continent it has been found in South France as low as the Miocene.

MIOCENE.—Abbe Dupuy records it as fossilized in all the lacustrine deposits in the north-east of the department of the Gers. At Sansan it occurs in a pocket of "terre marneuse" enclosed in the limestone; it has also occurred at Touzac, Mirande, Idrac, and Durand, but usually only in the form of casts. Dr. Paladilhe notes the finding of a probable specimen of the species enclosed in a block of Molasse at St. Bauzille de la Sylve, between Gignac and Pouget.



FIG. 343.—*Philodromus limacum* Jenyns $\times 30$, an ectodermic parasite of *Helix nemoralis*, etc.

PLIOCENE.—In East Suffolk, it is recorded by Prof. J. Morris from the Coralline crag at Sutton and Gedgrave ; it has also been found in the Red Crag at Butley pit near Orford (Sci. Goss., July 1889).

In France, Locard records this species from the Lower Pliocene strata of Hauterive, Drôme. M. Bouillet says it is rather common in Auvergne in the compact "travertin" of the Tambour, on the left bank of the Allier, near Martres-de-Veyre ; in those at Bard, near St. Germain-Lembron, and in the greenish clays covering the tufa. It is also present in the deposits of the Quercy, the Agenais, and at Sancats and Bordeaux, Gironde ; also in the neighbourhood of Lyons, Rhône ; and Dax in the Landes.

In Holland, it is reported from the Pliocene by Mr. J. Wilfrid Jackson.

PLEISTOCENE.—In South Devon, it was found by Mr. Pengelly during his explorations of Happaway Cavern, near Torquay.

In South Wilts. it is recorded by Mr. Trovey Blackmore from the loess of Fisherton Anger near Salisbury.

In Dorset, it is recorded by Rev. R. Ashington Bullen from a late Pleistocene deposit on Portland Bill.

In West Sussex, it is recorded by Mr. J. P. Johnson from beds exposed at low tide on the foreshore at West Wittering.

In Cambridge, Mrs. McKenny Hughes records the fasciate forms as common in the gravel deposits at Barnwell Abbey, Grantchester, and Barrington, all in the vicinity of Cambridge.

In West Kent, it is recorded from the lacustrine mammalian beds at Erith and Maidstone ; Prof. Boyd Dawkins has noted it from the lower brick-earth at Stoneham's Pit, Crayford, from which place Mr. B. B. Woodward has recorded very large specimens, one being 29 mill. in diameter. Mr. W. J. Lewis Abbott has found numerous specimens in the Ightham fissure near Wrotham, which though exhibiting great variety were generally more depressed and larger than recent shells, specimens 24 mill. in diameter being common, and five-banded shells forming sixty-two per cent. of the whole number found.

In South Essex, Prof. Morris records it from the elephant-bed at Uphall brickfield, Ilford ; Dr. Corner and Mr. Hinton note it from the sandy layer beneath the brick-earth, at the same place, and also in Sam Green's Pit. Mr. W. T. Blandford found specimens in the sections disclosed during the excavations for the Victoria and West India Docks ; and Mr. Worthington G. Smith has found it in the sandy deposits of the Lea Valley. In North Essex, it is recorded from Harwich by the late Dr. S. P. Woodward, and by Prof. Morris from the lacustrine beds associated with mammalian remains at Grays, Copford, and Clacton.

In Middlesex, it has been found by Mr. W. G. Smith on the "Palæolithic floor" at Stoke Newington near Clapton railway station.

In Salop, it is reported by Mr. W. Whitwell from amongst the deeply buried Roman pottery, unearthed at Wroxeter, the ancient Uriconium.

In Mid-Lancashire, it has been found by Mr. J. Wilfrid Jackson amongst the cave-earth of the Dog Holes, Warton Crag, near Carnforth.

In South-East Yorks., it is recorded by Mr. Thomas Sheppard from the beds at Bealsbeck, near Market Weighton, associated with bones of the mammoth, etc.

In Germany, it is recorded by Sandberger from Middle Pleistocene tufa beds at Cannstadt, Weimar, Muhlhausen, and Burgtonna, Thuringia, though never plentifully, and in typical form in tufaceous beds of Upper Pleistocene age at Weimar, Muhlhausen, and Burgtonna, Thuringia, and Canth, Silesia. Dr. von Ihering records it from diluvial tufa at Streitberg and Ober Zaunsbach in Franconia; O. Schmidt from Taubach, Thuringia; S. Clessin from tufa about Regensburg, Bavaria; and *Helix nemoralis* var. *major* for Arnzburg, Lower Franconia.

Helix tonnensis is described by Dr. Sandberger as very rare in tufa of Upper Pleistocene age at Burgtonna, Thuringia; and by Clessin from the tufa of Unteralling near Regensburg, Bavaria.

In France, it is recorded by Prof. Prestwich from the high-level gravels of the Somme. In the Alpes Maritimes, Comm. Cazier cites it as common in all Pleistocene deposits about Villefranche-sur-Mer, and as quite typical from the "Limons" at the mouth of the Var; while G. Nevill records a form regarded as a variety in the marl bed at Cape Mortela near Mentone. Sandberger reports it from the Upper Pleistocene deposits at Montreuil, Joinville, and Clichy in the department of the Seine; and M. Locard from Bas Boulonnais, Pas-de-Calais; Vallières-les-Grandes, Indre et Loire; Kers, Haute Garonne; in the Cavernes de Poudres, Gard; and the Grottoes of Grimaldi, Porto Maurizio, Corsica; and from Middle Pleistocene strata in the environs of Marseilles, Bouches-du-Rhône, and Celle, Seine-et-Marne.

In Italy, it is reported from Tuscany in the post-Pliocene conglomerate with mammalian bones at Monte Tignosa near Leghorn; and by Dr. Pantanelli from post-Pliocene deposits at Colle Val d'Elsa and Chiusdino.

HOLOCENE.—In West Cornwall, it has been recorded by Kennard and Warren from Newquay, in a loamy-sand deposit of late Pleistocene or early Holocene age, from whence a fossil dart of the species was obtained; specimens were also found in the æolian sands capping Towan Head. Rev. R. Ashington Bullen found very large specimens in the "kitchen-midden" just outside the late Celtic cemetery, Harlyn Bay.

In North Devon, it was discovered in the raised beach at Saunton in 1903 by Mr. F. J. Partridge.

In South Somerset, it was found commonly in 1907 by Mr. H. St. George Gray in the excavation of Wick Barrow, known locally as "Pixies' Mound," at Stoke Courcy, and attributed to the Bronze age.

In North Wilts., it was found by Mr. H. St. George Gray in deposits of Bronze age at Avebury; also at a depth of six feet in a deposit of Roman age, and from the superficial earthy layer during the same excavations. In South Wilts., Rev. R. A. Bullen records the species from a rain-wash in West Harnham chalk-pit, Salisbury.

In Dorset, it is recorded by J. C. Mansel-Pleydell and Clement Reid from the tufaceous beds at Blashenwell, near Corfe Castle, and quite contrary to Mr. Abbott's experience in Pleistocene deposits Mr. Reid especially remarks on the total absence of all intermediate forms linking this species with *hortensis*, all the *H. nemoralis* being large, depressly globose, and of an uniform yellow or amber colour with dark lips, while the *H. hortensis* were smaller and more globular, very pale and five-banded. Rev. R. A. Bullen records it from the superficial deposits on the downs above Durdle Barn Door and behind Swyre Head; and Mr. Harold St. George Gray found many examples during the excavation of the Roman amphitheatre at Dorchester, now known as "Maumbury Rings."

In the Isle of Wight, it is recorded by Prof. Forbes from the lacustrine beds at Totlands Bay; by Bristow from subaërial beds on St. Catherine's Down; by Mr. C. Ashford from a shell-layer about twenty inches beneath the surface, disclosed by the cutting of a path down the cliffs at Orchard Bay; and by Kennard and Warren from a bed of calcareous tufa, overlying the *Potamomya* sands and eight to ten feet below the top of the cliff, a little south-west of Widdick Chine.

In Hants. S., it is recorded by Mr. J. T. Kemp as common in tufa on site of Southampton Docks; also in the Test Valley at Mottisfont, and the Itchen Valley near Winchester.

In Sussex W., it was enumerated by Mr. Alfred Bell in 1871 as amongst the mollusks found in the "mud deposit" at Selsey; and Mr. R. M. Christy found specimens in 1878 beneath the loose earth filling up the pits in the ancient Roman camp at Cissbury. In East Sussex, Mr. J. P. Johnson found it near the base of a Neolithic chalk rainwash, overlying the Palæolithic rubble drift, to the east of Brighton.

In East Kent, the Rev. R. Ashington Bullen found specimens at a depth of four to six feet in a section exposed by the cutting of a road under the South Downs. In West Kent, Mr. A. Santer Kennard found it abundantly with bone fragments and Roman pottery at the base of a rain-wash, from two to six feet thick, on the site of a large Roman building at Darenth, and commonly at base of tumulus, Stanley's Quarry, Ightham; Mr. F. C. J. Spurrell in ditches, Erith Marshes, and in the sections exposed by the excavations for sewer outfall at Crossness; and the Rev. R. A. Bullen from deposit overlying the head or rubble drift at Barton Court, Buckland, Dover.

In Surrey, it is recorded by Kennard and Warren from the carbonaceous silt of Roman age, disclosed by the excavations in Tooley street, Bermondsey; by Mr. C. Evans from the excavations for the Charing Cross railway in Blackfriars; by Rev. R. Ashington Bullen at depths varying from eighteen inches to three feet in a mixture of Upper Chalk and Upper Greensand, in the Upper Greensand pit, east of the Horseshoe pit, Reigate; and by Mr. L. E. Adams as moderately common in the same district from an old chalk-pit, the Horse-Shoe pit, and from a section at Betchworth.

In South Essex, it is recorded by Kennard and Woodward as very common in the beds of loamy clay, sand, and shell-marl disclosed during the excavations for reservoirs at Walthamstow; and Dr. Frank Corner found it in layers, alternating with mud and peat, during the sewer excavation between Canning Town and Stratford. In North Essex, Mr. Miller Christy has found the species abundantly in the black earth and peat beds along the banks of the river Cann, Chignal St. James; and Mr. J. French has recorded it from the shell marl at Felstead. Dr. S. P. Woodward has reported it from the post-glacial beds at Witham; Rev. A. J. Law from a drain-section at a depth of 3-3½ feet in "the Marsh," near Shalford Vicarage; and Mr. R. W. Christy from alluvium exposed by the draining of a field on Duke's Farm, Roxwell.

In Herts., Mr. J. Hopkinson has recorded it from the alluvium disclosed by the excavations for the gas-works at Watford; and Mr. Fordham obtained specimens from the sub-soil of a tumulus at Highley Hill, Ashwell.

In Middlesex, Mr. J. E. Cooper has found specimens with other species in the excavations near the gas-works, Staines; and Kennard and Warren found a single shell in a marl-bed on left bank of river Thames by the

tow-path to Old Windsor, about a mile west of Staines. In the city of London, near the Guildhall School of Music, in a sandy section, at a depth of ten to fifteen feet below the surface, disclosed by sewage operations, this species was found by Mr. W. J. Lewis Abbott.

In Oxford, Kennard and Warren record it from a greyish marl on the bank of the river Thames, near Clifton Hampden.

In Cambridge, it is recorded by Rev. R. Ashington Bullen from a superficial deposit of Romano-British age at Harlton near Cambridge.

In East Gloucester, it is recorded by Hinton and Kennard from all the enumerated beds in the gravel pit at Cleeve Hill.

In Hereford, Mr. J. E. Ballard found specimens in an alluvial deposit, disclosed by draining excavations, close by the churchyard at Ledbury.

In Glamorgan, Mr. Storrie found examples at considerable depths during the excavations of a Roman villa at Llantwit Major, near Cardiff.

In Notts., Mr. Musson records it in a black alluvium, three to four feet in thickness, overlaying Keuper-Clay, on the moors at Bingham and Gotham.

In South-West Yorks., it has been reported by Dr. Corbett from the ancient lacustrine deposit at Askern near Doncaster. In Mid-West Yorks., Mr. J. Wilfrid Jackson records it from the alluvial beds of the Ribble Valley near Great Mitton; and Mr. G. Roberts from the old bed of Bishopdyke near Sherburn.

In Ireland, it has been found in Antrim by Mr. R. Welch in the old land shell "pockets" on the dunes at Whitepark Bay.



FIG. 344.—One of the few isolated remnants of the Holocene land shell deposit, Dog's Bay, Galway West (from photo. by Mr. R. Welch).

A.—Topmost layer of sand with grass roots and very few shells.

B.—Old land surface, black in colour, full of shells of *H. nemoralis*, etc., of ordinary form.

X.—Foraminiferous sand with shells more sparingly distributed.

C.—Lower zone, full of the large and heavy race of *H. nemoralis* and but few others.

The surrounding ground is covered with talus made up by a mixture of the various zones as they become gradually disintegrated and scattered by the weather.

In Donegal, Mr. R. Welch found it abundantly in the kitchen-middens and in the land shell deposits beneath them at Rosapenna and Tranarossan, Rosguill peninsula; in a rain-wash, Horn Head, and plentiful in deposit at base of old dunes, Finner Strand, Bundoran; Mr. A. W. Stelfox also found it abundantly in a three-inch zone below the "kitchen-midden" on the dunes, Carrickfin peninsula near Bunbeg.

In Sligo, it is found calcareted in the solid sandstone bands at base of old dunes, Strandhill.

In West Mayo, Mr. J. G. Milne obtained it in Aug. 1886 from the "kitchen middens," Dugort, Achill Island.

In West Galway, it is found plentifully in the Dog's Bay deposits, but the var. *ponderosa* is not now found in the "Black band," where it was first discovered, but in a zone much lower.

In Clare, Miss Parkinson found it abundantly in the crannogues at Drumcliff and Clanreen, Ballyallia Lake, Ennis, and very large and heavy specimens (one measuring 27 mill. in diameter and 27 mill. in altitude) in the Doonbeg sandhills, Lehigh.

In Belgium, it has been found by M. Jules Colbeau in tufa at Marches-Dames, Namur. In Brabant, it is recorded by Van den Broeck in tufa near St. Gilles; by Raeymaekers in ancient alluvium near Brussels; and by M. Gregoire in the "Tourbe" at Uccle lez-Bruxelles.

In France, M. Fagot records small specimens in the grey clays of Hers, and finer individuals from Caraman, in the commune of Avignonet, Haute Garonne; and Mr. J. Paget discovered it in the alluvium behind the fortress at Montpellier, Hérault.

In Sweden, it has been recorded by Dr. Westerlund from the Swedish peat moors.

In Denmark, Dr. A. C. Johansen has recorded it from Jutland, in the ancient Neolithic "kitchen-midden" at Meilgaard; and from the marl-beds at Gytje; on the Island of Zealand it has been found in the old Neolithic deposit by the Free Harbour, Copenhagen.

Variation in Animal.—Few variations or anomalies in the animal have been chronicled, although the colour of the body may vary through many intermediate shades from a pale greenish-grey or white to a very deep leaden hue or almost black. The Rev. R. Ashington Bullen, however, found a specimen of the var. *rubella* at Sevenoaks, in Sept. 1893, possessing three anterior tentacles, the additional one, though quite apart from, was nearest the right tentacle, and all three were equally used as tactile organs. Dr. Fischer also records a specimen collected at Savigny-sur-Orge, Seine-et-Oise, which possessed on the rear upper part of the foot a subclaviform fleshy growth, about one centimetre in length, and capable of contraction and elongation, and which was held almost vertically when the animal was in motion.

Variation in Shell.—In this species, the most protean of our native land shells, the variations in ground colour, banding, size, substance, sculpture, and lip colouring, are almost infinite, and it would be too immense a task to detail the distribution and recorded localities of the innumerable modifications. It should, however, be borne in mind that although many of the shells are here registered under a single varietal

character, yet, as in other species, and in this pre-eminently so, almost every specimen combines within itself several of the recognized varietal characters, and to fully express the peculiarities of any single shell, it would be necessary to use two or more of these varietal names, and this act would not be a reversion to the old polynomial system of general descriptive nomenclature, but would, on the contrary, constitute a strictly precise and accurate terminology.

Many causes have been suggested to account for the great differences in colour and banding—as the nature and colour of the soil, the character of the food plants, the nature of the district, whether more sunny and exposed or sheltered and shady, and whether arid or damp—and it is certain that these factors do affect variation, and are a sufficient influence to initiate many special modifications.

The ground colouring in the shell of this species is very variable, and would appear to be in an inverse ratio to, and its depth acquired at the expense of, the intensity of pigmentation of the banding, as in those shells with the most deeply tinted ground the bands, when present, are usually few in number, or feeble and rudimentary, while those shells with paler ground colouring have often darkly pigmented and well defined bands.

The suggestion of Dr. Dall that the striping of the shell may conduce to concealment, and be therefore protective in the same way as the striping of the tiger, zebra, and other animals, is apparently borne out by the exhaustive analyses of the shell remains of a large number of “thrushes’ altars” by Rev. E. Adrian Woodruffe-Peacock who, as a result of their examination and tabulation established that about Brigg, Lincolnshire, the var. *libellula* 00000 is much more frequently destroyed than other varieties, the relics of the single-banded variety being next in abundance, although these forms are not the commonest in the districts examined, which leads to the inference that these two forms are more readily seen in that district than the typically banded shells.

Distinctly and darkly banded shells are most prevalent in shady and umbrageous situations, amidst a luxuriant vegetation, and the absence of the banding on the upper surface may possibly be correlated with dwelling in elevated, open, bright, and sunny stations.

The darker and duller shade, frequently seen at the base of the shell around the umbilicus, which has been conjectured by Dr. Williams to be a discolouration and due to dampness, is more probably an atavistic evidence of a former colouring and may be regarded as quite analogous with the whitish opacity around the umbilicus of certain *Hyalinice*, which is a relic of a former more cretaceous shell.

Though the colour varieties are sporadically found in widely separated places, they are often plentiful in restricted districts favourable to their evolution and perpetuation; thus the unicolorous brilliant yellow variety is said to abound in the open sunny fields about Geneva and elsewhere; and a yellowish variety is recorded by Prof. Howe as prevalent in several localities about Lexington, among yellow leaves. A pale form of the variety *libellula* is by far the most abundant and widely dispersed of the coloured forms in this country, yet at Aberystwyth and in certain parts of the more humid west of England, it becomes dominated by the darker and more sombre-coloured var. *olivacea*, which inhabits moister and more shaded localities.

Prof. Beddard, on the authority of Leydig, remarks on the rich citron-yellow of the shells inhabiting the sunny hillside vineyards of the Mid-Rhine Valley, and emphasizes the change to red of the shell in the vicinity of Bonn, and the deepening into chocolate-brown lower down the river as the moister districts nearer the coast are approached.

The var. *albina*, though occasionally locally common, sometimes, as at Meylan, Grenoble, occupies a district to the exclusion of other forms.

The var. *rubella* is the most abundant form in East Prussia and other parts. It is also quite predominant within a restricted area at Bettws-y-Coed, Carnarvonshire, and the most plentiful form at Porthleven, Cornwall, and other western localities; while the var. *albolabiata* is quite as plentiful as the dark-lipped shells in the Pyrenean Mountains, and nearly as numerous in the west of Ireland.

The different types of banding show similar local concentration, the typical banded form—which in its many modifications is so common—being quite unknown in South Bavaria, where the formula 00345 is the prevalent form, it is also one of the most plentiful in Wurtemberg, Normandy, many parts of Belgium, etc. In this country it is most frequently found on open elevated slopes, and Mr. L. E. Adams has recorded it as especially plentiful on the sunny railway embankment at Great Houghton, Northamptonshire.

The vars. *punctata* and *interrupta*, whose peculiarities are due to the intermittent action of the pigment glands, are with a yellow ground colour often dominant on the arid and minutely parti-coloured sand dunes by the sea, with scanty vegetation, as at Portsalon, Donegal, Spurn Point, Yorkshire, etc.; in the last locality nearly every specimen belonged to the var. *punctata*.

The var. *undulata* is a modification of the preceding forms, constituted by the transverse fusion at various intervals of the broken banding; it is the common form about Keswick and Bassenthwaite in Cumberland, but is far from being a generally prevalent form.

Mr. E. Collier has observed at Carrickfin, Donegal, where the var. *citrinozonata* is locally plentiful, that the inhabited ground is closely overspread by a rank growth of a yellow mushroom-like fungus, approximating closely in colour and size to the shell, which thus probably reaps the benefit of protection from the resemblance.

The var. *rubella* has been noticed by Lieut.-Col. Parry to display a similar harmony with a favourite habitat, as at Eaux Chaudes, Basses Pyrénées, where at an altitude of about 2,200 feet, it lives amongst the box trees, the colour of the shell exactly matching the colour of the red fallen leaves upon which the animals live and feed. At Ayelès, where there are no box trees, the red variety is not found.

This effect of environment is also strikingly shown in North America, in the modifications now being undergone by the Virginian colony of this species, which shows in addition to a greatly increased and extraordinary tendency of the normal banding to split up into numerous supplementary bandlets (a feature which is comparatively or quite rare in this country and Europe, but at Lexington is affecting almost five per cent. of the total specimens found), there is also a remarkable lack of the brilliant coloration the species usually presents in Europe, and an approximation to the sombre hues characteristic of the North American *Helicidæ*.

As in other species, the shell is more liable to be thick and ponderous in limestone districts with a mild and equable climate, yet the development of a stout and heavy shell is dependent on the selective action of the tissues of the animal, as heavy shells may be secreted in districts in which cretaceous material is scarce, while thin shells are not uncommon where abundance of calcic matters may be present.

As in all the Pentatæniate species, *Helix nemoralis* normally possesses five spiral bands, which are constant in their position, three being always above the periphery and two always below, but they are subject to a marvellous amount of variation, not only due to the total absence of one or more of the bands, or their coalescence in diverse combinations, but also to the widely differing widths to which each band and each interspace is liable, while the more or less irregular pigmentation which results in indistinct, irregular, spotted or transparent banding is very striking.

A convenient method, which is almost universally adopted, of recording the variations in the number of the bands present and their mode of fusion, was devised many years ago by Herr Georg von Martens, by which a distinctive numeral expressive of its position on the shell is applied to each of the five bands normally present, the uppermost band or one nearest the suture being the first, and the lowermost or one nearest the umbilicus the fifth, the type form with its five bands being indicated with the formula 12345.

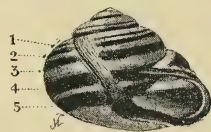


FIG. 345.—*Helix nemoralis* L., showing method of band notation.

A modification was proposed by M. Albin Gras, who suggested that the numbering of the bands should commence at the base of the shell and that the vowels *a, e, i, o, u*, be used instead of the numerals advocated by Herr von Martens.

The banding when imperfectly developed and showing as a series of more or less disconnected spots or blotches is usually represented by a colon (:) in place of the numerals which would be used to indicate a normal band; the formula :::: would be used to denote that the five bands were irregularly developed.

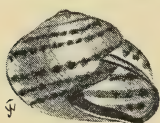


FIG. 346.

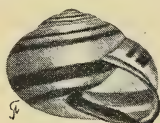


FIG. 347.

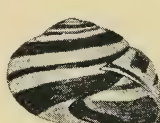


FIG. 348.

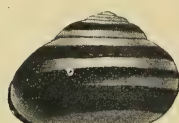


FIG. 349.

Helix nemoralis L., showing the mode of registering indistinct and deficient banding and the various modes of band diffusion.

FIG. 346.—Shell showing all the five bands as indistinctly or irregularly developed and usually expressed by the formula ::::.

FIG. 347.—Shell showing the suppression or absence of the third or peripheral band, recorded as 12045.

FIG. 348.—Shell showing the fusion of the two uppermost and also of the two basal bands, the peripheral band only being free, and formulated as (12)3(45).

FIG. 349.—Shell showing band-fusion occurring during growth, and the combination of all the bands at the aperture when adult, and represented by the formula [(12)(3(45))].

If, however, a band or bands be missing, this is signified by the use of a cypher or cyphers in place of the numeral or numerals representing the particular band or bands which may be missing; thus, if the third band only be wanting, this would be expressed by the formula 12045, or if all the bands are missing, the formula is 00000.

The coalition or fusion of the banding is conveniently shown by enclosing the fused bands between parentheses, the formula (12)3(45) indicating that the first and second bands are joined together, and also the fourth and fifth, the third or peripheral band only being free.

When it is desirable that the details of the mode of fusion be given with more precision, this method may be further perfected: thus, the formula [(12)(3(45))]) would indicate that the bands 1 and 2 are fused together, and that bands 4 and 5 are also united, band 3 fusing later with the previously coalesced bands 4 and 5 as is shown by its separate parenthetical enclosure; the whole five bands finally uniting together at the aperture, which is shown by enclosing the complete formula within brackets [].

Supplementary or extra bands are, however, occasionally present, so that a shell may seem to have six, seven, or more bands, and this feature is extraordinarily and startlingly developed in the colony at Lexington, Va., where a specimen with as many as twelve bands has been recorded, and Prof. J. L. Howe actually chronicles no less than 188 different forms of these multiple-banded varieties; these additional bandlets are, however, not due to a real increase in number of the bands, but arise from the sub-division or splitting-up of the normal five, consequently these extra bands are always narrower than the undivided band would have been; this sub-division it has been suggested can be indicated by a smaller numeral placed in the position of the split-off bandlet, the formula 123₃45 showing that the third band was split along its lower edge, and that the subsidiary bandlet is feebly developed and rudimentary. In some cases, the split-off bandlet is strong and continuous, the band being separated into two or even more approximately equal or sub-equal parts; this would be expressed by a suitable repetition of the appropriate numeral, the formula 123345 showing the division of the third band into two equally strong and distinct bandlets.

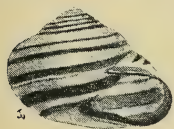


FIG. 350.

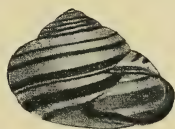


FIG. 351.

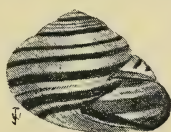


FIG. 352.

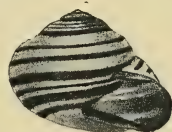


FIG. 353.

Helix nemoralis L., with extra or supplementary banding, and showing the method of recording the variations.

FIG. 350.—Shell showing a rudimentary bandlet split off from the lower edge of the third or peripheral band, the suitable notation being 123₃45.

FIG. 351.—Shell showing a strong and continuous bandlet split off from the peripheral or third band, the notation being 123345.

FIG. 352.—Shell showing a feeble and rudimentary extra band between bands three and four, which should be recorded as 123₃45.

FIG. 353.—Shell showing a strong and continuous extra band, similarly placed to that in Fig. 352, and recorded as 123 X 45.

In some cases the additional bandlets may be placed equi-distantly between two adjacent bands, so that the appropriate numerals indicating their origin cannot with certainty be determined; in such cases when the band is distinct, continuous, and strong, a capital x is used instead of a numeral to indicate its presence and position, as 123x45 when the additional bandlet is between the third and fourth band, and a small x when the extra bandlet is weak and rudimentary, the formula 123₃x45 would show that the extra band though similar in position was feebly developed.

Although the chief peculiarities of the individual shells may thus be readily recorded by means of the formula described, yet if the precise aspect

of the shell is desired to be accurately conveyed, a more exact system of notation is needed. M. Jules Sauveur,¹ sensible of the deficiencies of the method usually adopted, proposed that three degrees of breadth of band and their interspaces should be recognized; the narrow band or interspace which should be less than half a millimetre in width, and indicated by a full point (.) ; a broad band or interspace, which should exceed $1\frac{1}{2}$ mill. in width, and be indicated by a horizontal line (—); and a median band or interspace which should range from half a millimetre to $1\frac{1}{2}$ millimetres

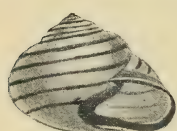


FIG. 354.

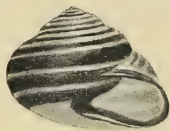


FIG. 355.

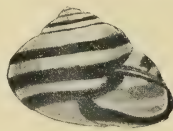


FIG. 356.

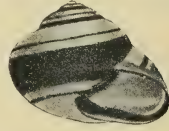


FIG. 357.

Helix nemoralis L., showing the greater precision of the Sauveurian method in indicating the character of the banding.

FIG. 354.—Shell with five bands and indicated by the formula $\dot{1}-\dot{2}-\dot{3}-\dot{4}-\dot{5}$.

FIG. 355.—Shell bearing the same bands, but the increased breadth indicated by $\dot{1}.\dot{2}.\dot{3}.\dot{4}.\dot{5}$.

FIG. 356.—Shell with four bands, formulated as $0-\overline{2}-(\dot{3}\dot{4})-\dot{5}$.

FIG. 357.—Shell bearing the same bands, and indicated by the formula $0\dot{2}-(\dot{3}\dot{4})-\dot{5}$.

in breadth, and be represented by a comma (,). By the use of these three additional signs, practically all the band variations and their peculiarities may be precisely recorded, and as it is calculated that—without allowing for the supernumerary or interrupted banded forms—there may be 17,656 modifications of the banding in specimens with from one to five bands, these slight modifications of the usual formula would appear to be desirable.

Dr. Boycott and Rev. E. W. W. Bowell have also proposed a method of indicating the relative importance of each band; they agree with Sauveur that three grades of strength should be recognized: full, half, and quarter strengths. If, for example, the third band be of full strength or more—and in estimating the relative strength, a deeply pigmented narrow band is considered to be equivalent to a broader and paler one—they propose it shall be indicated by the ordinary numeral 3 in the usual way; if the band be half strength only, it would be shown by the fraction $\frac{2}{3}$, the denominator being the numeral denoting the position of the band, the numerator being the numeral 2 to typify the half strength of band; similarly a band of quarter strength would be represented by $\frac{1}{3}$.

Rev. E. Adrian Woodruffe-Peacock has detected a certain degree of correlation or relationship between the various bands, observing that when the second band is absent, the fourth band is also absent or greatly reduced; and if the third band be less than normal width, the fifth is usually diminished on the basal side. He has also devised an ingenious method of registering the relative dimensions of each band and each interspace.² He conceives the entire space occupied normally by the five bands to be divided into twenty-four equal spaces, and apports these out according to the various widths of the bands and spaces in each individual, the numeral used not representing the position of the band or interspace, but the number of such spaces it occupies. On this system, the typical five-banded shell would be expressed by the formula 122234433 , the large figures representing the relative breadth of the bands and the smaller figures the widths of the interspaces.

¹ Annales Soc. Mal. Belg., ii., pp. 59-108.

² Naturalist, 1909, pp. 171-174 and 257-259.

Many of the different variations of bandings that have been observed have been distinguished, more especially by French authors, by the application of definite names and I have listed under their appropriate ground colouring all the forms so treated at present known to me.

Without taking account of the varied widths of banding and interspacing, interrupted bands, or their degree of pigmentation, shade of colouring or transparency, there are, when the number of bands does not exceed the normal five, **89** possible variations.

Though the number of possible band combinations in the shell are so numerous, and all have now been actually recorded or are known to have occurred, yet it is surprising how few of these are really commonly found. The commonest banded forms in this country are 00300 and 00345, and some of the combinations of 12345; the relative persistence of the banding being shown by the sequence 34521; the third or peripheral band is not only the most persistent, but is the first to be developed on the growing shell and is the longest; the basal or fifth band being the last to appear and is usually the shortest.

The **five-banded** group contains sixteen varieties, and includes several of our commonest forms, and although one formula has not hitherto been reported from the British Isles, there can be little doubt that it exists in this country.

1 2 3 4 5	(123)45	(12)(345)	1(23)45
(12345)	(123)(45)	(12)(34)5	1(23)(45)
(1234)5	12(345)	(12)3(45)	12(34)5
1(2345)	(12)345	1(234)5	123(45)

Of these the commonest are perhaps 12345, (123)(45), and (12)3(45); somewhat rarer or more local are (12345), 1(23)(45), (12)345, (123)45, 1(23)45, and 123(45). The remainder are all comparatively rare, but have been met with several times in this country, and recorded from the continent; but 12(34)5 has only been found in Germany, Belgium, and Virginia, U.S.A., and has not yet been found in this country.

The **four-banded** section embraces twenty-eight different forms, and includes a large proportion of the rarest formulæ.

1 2 3 4 0	12(34)0	120(45)	0(2345)
(1234)0	1 2 3 0 5	(12)0(45)	0(234)5
(123)40	(123)05	1 0 3 4 5	0(23)(45)
(12)(34)0	(12)305	10(345)	0(23)45
(12)340	1(23)05	10(34)5	02(345)
1(234)0	1 2 0 4 5	103(45)	02(34)5
1(23)40	(12)045	0 2 3 4 5	023(45)

The commonest formulæ are 10345, 12045, and 02345. Very much rarer are (1234)0, (123)40, (12)340, (12)(34)0, (12)305, and 12(34)0, which are on record for Germany only, and have never yet been met with in the British Isles. As exceedingly rare British forms, not hitherto recorded from abroad, mention may be made of 0(234)5 reported by Mr. J. H. Ashford; 123(05) reported by Rev. Canon Horsley and Mr. B. Hudson; 10(345) by Mr. C. E. Wright; 02(34)5 by Prof. Cockerell and Mr. Ashford; and 10(34)5 by Rev. Canon Horsley; while 1(23)05 is only known from Ireland, collected by Miss Smith at Piperstown, Co. Louth.

The remaining forms have all been found in this country and also abroad, but are very rare, and probably exist in very few collections.

The **three-banded** forms are twenty-five in number :

1 2 3 0 0	(12)005	0(234)0	0 2 3 0 5
(123)00	1 0 3 0 5	0(23)40	0(23)05
(12)300	1 0 3 4 0	02(34)0	0 2 0 4 5
1(23)00	10(34)0	0 0 3 4 5	020(45)
1 2 0 4 0	1 0 0 4 5	00(345)	
(12)040	100(45)	00(34)5	
1 2 0 0 5	0 2 3 4 0	003(45)	

The formula 00345 is much the most abundant form, 12300, 02340, and 10305 being far more uncommon. The (123)00, (12)040, (12)005, and 02(34)0 are only on record for Germany, and have not yet been reported as British ; while 10045 and 0(234)0, reported by Mr. C. E. Wright are, as far as at present known, peculiar to this country.

The remaining seventeen are all quite rare, and very few specimens are known.

The **two-banded** varieties are fourteen in number :

1 2 0 0 0	0 0 3 4 0	1 0 3 0 0	0 2 0 0 5
(12)000	00(34)0	1 0 0 4 0	0 0 3 0 5
0 2 3 0 0	0 0 0 4 5	1 0 0 0 5	
0(23)00	000(45)	0 2 0 4 0	

The commonest varieties are 00045, 10300, 00305 and 00340. The formula (12)000 is only at present known from Germany, and 02040 from this country ; while 02005 and 10040 are reported from the British Isles and America. The remainder are all very uncommon or rare, but are known to exist in this country and abroad.

The **one-banded** form exists in five varieties only :

1 0 0 0 0	0 0 3 0 0	0 0 0 0 5
0 2 0 0 0	0 0 0 4 0	

The formula 00300 being very common, the remaining four are rare, all of which are apparently more common on the continent than in this country. The formula 00300 is always the most abundant form, 00040 and 00005 being quite uncommon in the British Isles, though not so rare as 10000 and 02000.

The **bandless** form 00000 is one of the very commonest varieties in this country and abroad.

VARIATIONS IN FORM OF SHELL.

Var. **acuminata** Baudon.

Helix nemoralis var. *acuminata* Baudon, Moll. Oise, 1862, p. 19.

Helix nemoralis var. *conoidea* Clessin, Nachrichtstbl. Deutsch. Gesellsch., 1871, p. 126.

Helix nemoralis var. *elevatus* Norguet, Moll. Nord. 1872, p. 272.

Helix nemoralis var. *conica* Pascal, Moll. Haute Loire et Paris, 1873, p. 34.

Helix nemoralis var. *trochoides* Clessin.

The var. **acuminata** is held by its author to be sufficiently described by its name ; he, however, in his 1884 catalogue substituted the name *conica* for that of *acuminata* on the ground that the shell was really more conical than acuminate.

The sub var. **conoidea** is described as more elevated, so that the peripheral or third band is clearly visible to the apex. Diam. 22 mill. ; alt. 18 mill. The illustrative figure (Deutsche Moll. Fauna, p. 207, f. 121) has an equal diameter and altitude of 23 mill.



FIG. 358.—*Helix nemoralis* sub-var. *conoidea* Clessin. (Seacrott, near Leeds).

ENGLAND AND WALES.

Channel Isles—Bon Repos, Guernsey, one 16 mill. in diam. and alt. (Tomlin and Marquand, Journ. of Conch., Jan. 1903, p. 288).

Cornwall W.—Truro, alt. 19 mill., diam. 21½ mill., J. H. James. St. Evat, June 1885 ! W. Vinson. Porthleven, Aug. 1900, Rev. J. W. Horsley.

Devon S.—Var. *conoidea*, Exeter ! E. Parfitt. Alphington, E. D. Marquand.

Devon N.—Coombe Martin rd., Ilfracombe, Aug. 1903, H. Beeston & C. E. Wright.

Somerset N.—Near Locking, 1883 ! J. Madison. Abbott's Hill, Bratton St. Maur, E. W. Swanton.

Sussex E.—Common on Brighton downs, Rev. J. W. Horsley. Lewes ! J. H. A. Jenner.

Kent E.—Faversham, July 1883, Miss Fairbrass. Sandwich, Aug. 1906 ! F. H. Sikes.

Kent W.—Near Chislehurst, 1882 ! T. D. A. Cockerell.

Middlesex—Finchley (Cooper and Loydell, Middl. Moll., 1909, p. 225).

Essex N.—Chelmsford ! R. Miller Christy.

Oxford—Oxford ! Rev. S. Spencer Pearce.

Norfolk W.—Sandhills, Hunstanton, Oct. 1894 ! T. Petch.

Gloucester E.—Gloucester, A. G. Stubbs.

Worcester—Var. *conoidea*, Wildon, J. W. Williams.

Pembroke—Gumfreston, A. G. Stubbs.

Cardigan—Pensarn near Aberystwyth, Sept. 1894 ! E. Collier.

Lincoln N.—Grisel-bottom, Louth, Aug. 1886 ! H. Wallis Kew. Sandhills, Mablethorpe, July 1907 ! F. Rhodes.

Lancashire S.—Park lane, Burnley, 1884 ! J. Russell Wildman.

York Mid W.—Malham, June 1883 ! W. West. Whinmoor, Leeds ! W. Nelson. Selby, alt. 19 mill. ; diam. 22 mill., Geo. Roberts.

York S.E.—Spurn, T. Petch.

York S.W.—Swithin near Barnsley, June 1908 ! W. E. Brady.

Cheviotland—Alnmouth, Rev. Dr. McMurtrie.

SCOTLAND.

Clyde Isles—Port Bannatyne, Bute, Sept. 1887 ! A. Shaw.

Cantire—Tarbert, Aug. 1886 ! T. Scott.

IRELAND.

Down—Common on the dunes, Killard Point, 1898, R. Welch.

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *conoidea*, recorded by Clessin from Dinkelscherben, Suabia ; and by A. Schmidt and Dr. Jordan from Schmiedeberg and Landskrone, Silesia.

France—Var. *acuminata*, Bordeaux, Gironde, R. F. Scharff ; rare by ditch sides on road between Mony and Hondainville, Oise (Baudon, l.c.). Sub-var. *conica*, meadows, Chaville, Seine-et-Oise (Pascal, l.c.) ; rather common on banks of the side canal of the Saône in the wood of Rosière, Auxonne, Côte d'Or (Wattebled, Journ. de Conch., 1889, p. 318).

Var. *planospira* Picard.

Helix nemoralis var. *planospira* Picard, Moll. Somme, 1840, p. 186.

Helix nemoralis var. *depressus* Norguet, Moll. Nord, 1872, p. 272.

Helix nemoralis var. *compressus* Terver, Locard, Mal. Lyonn., 1877, p. 30.

The var. *planospira* has the spire scarcely elevated above the body whorl, which thus seems extremely large, and the aperture nearly round and very oblique, with a subperforate umbilicus.

The sub-var. *compressa* is described as with a less elevated spire.

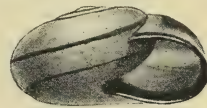


FIG. 359. — *Helix nemoralis* var. *planospira* Picard (Howsham, Lincs., Rev. E. A. W. Peacock).

ENGLAND AND WALES.

Cornwall W.—Newquay and Truro, alt. 15 mill., diam. 22½ mill., J. H. James.

Somerset N.—Hedgebank, foot of Bratton Hill, Bratton St. Maur, E. W. Swanton.

Lincoln N.—Howsham, on chalky boulder-clay, May 1901 ! Miss Ashton.

Derby—Monksdale, May 1885, T. Hey. The Winnatts, Castleton, July 1901, J. Wilfrid Jackson. Crich ! B. Sturges Dodd.

Lancashire S.—Burnley, Aug. 1887, J. Russell Wildman.

York N.E.—Sub-var. *compressa*, Ganton, J. A. Hargreaves.

CONTINENTAL DISTRIBUTION.

Germany—Recorded by Schmidt from Aschersleben, Anhalt ; and by Meyer as scarce at Rufach and Episheim, Alsace.

France—Described by Picard from specimens collected in the department of the Somme; and sub-var. *compressa* recorded by Locard from Pape and Vernay, near Lyons, Rhône.

Switzerland—Frutigen, Canton Berne, Aug. 1876 !

Denmark—Christianshavns Vold, Jutland, Niel Petersen.

Var. *porrecta* Westerlund.

Helix nemoralis var. *porrecta* Westerlund, Moll. Suède et Norv., 1871, p. 39.

SHELL with the last whorl not deflected at the aperture; the aperture more rounded, and the upper margin of the lip not reaching the fourth or sub-basal band as is usual.

IRELAND.

Donegal—Rosapenna sandhills, June 1910 ! R. Welch.

CONTINENTAL DISTRIBUTION.

Sweden—Malmö (Westerlund, l.c.).

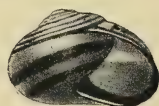


FIG. 360.—*H. nemoralis* var. *porrecta* Westl. (Rosapenna, Donegal, Mr. R. Welch).

Var. *umbilicata* Cockerell.

Helix nemoralis mut. *umbilicata* Cockerell, The Nautilus, Dec. 1894, p. 94.

The mature shells retain a distinct umbilicus, not becoming covered in adult life.

ENGLAND.

Kent W.—An adult shell with an open umbilicus has been found in the pleistocene deposit within the Ightham fissure, Wrotham, by Mr. W. J. Lewis Abbott.

Derby—The Winnatts, July 1901, J. Wilfrid Jackson.

IRELAND.

Galway W.—Killeany, Aranmore, July 1895, R. Standen.

FOREIGN DISTRIBUTION.

United States—Sub-var. *petiveria* 123x45, Lexington, Virginia, Prof. Morrison (T. D. A. Cockerell, l.c.).

VARIATIONS IN SIZE OF SHELL.

The variations in size of shell have been distinguished by many names expressive of the unusually large sizes attained under favourable conditions or in certain districts, and others have been applied to differentiate the shells of unusually small dimensions. The ordinary sized examples, which represent the type of the species, have been distinguished as var. *media* by Dumont and Morillet, who ascribe to it a diameter of 20-21 millimetres.

Var. *major* Férussac.

Helix nemoralis var. *major* Férussac, Tabl. Syst., 1821, p. 35, pl. xxxiv., ff. 10, 11.

Helix nemoralis var. *maxima* Charpentier, Moll. Suisse, 1837, p. 7, pl. 1, f. 5.

Helix lucifuga Ziegler in Hartm., Gaster. Schweiz., 1844, p. 191, pl. 70.

Helix nemoralis var. *gigantea* Grateloup, Cat. Moll. France, 1855, p. 9.

Helix nemoralis var. *magna* Stabile, Prosp. Sist. Moll. Lugano, 1859, p. 26.

Helix nemoralis var. *apennina* Stabile, Moll. Piemonte, 1864, p. 66.

Helix nemoralis var. *major* Pascal, Moll. Haute Loire, etc., 1873, p. 34.

Helix nemoralis var. *gallica* Westerlund, Westl. Fauna Extr. Moll., 1878, p. 116.

Helix nemoralis var. *etrusca* del Prete, Bull. Soc. Mal. Ital., 1879, p. 78.

SHELL much larger than typical specimens.

The var. *major* Fér. *sensu stricto*, is figured as 32 mill. in diameter and 25 mill. in altitude; the sub-var. *major* Pascal is described as 28 mill. in diameter and 18 mill. in altitude.



FIG. 361.—*Helix nemoralis* var. *major* Férussac (after Férussac).

The sub-var. *maxima* is figured by Charpentier as 32 mill. in diameter and 20 mill. in altitude, with a formula of 00300, and described as roseolabiate.

The sub-var. *magna* is described as attaining a diam. of 30 mill.

The sub-var. *lucifuga* is described as gigantic, fasciate, or unbanded, scrobiculate, malleate, with transverse and spiral striation; aperture liver coloured, and rib pale flesh coloured, or rib purple and margin black, and figured as 35 mill. in diam.

The sub-var. *gallica* is of maximum size, variously fasciate, aperture white, or rarely with lip white, and rib and margin purple. Diam. 32-33 mill.; alt. 20-23 mill.

The sub-var. *etrusca* is large, distinctly striate, and irregularly but minutely malleated.

The *H. nemoralis* var. *appenina* Stabile, *H. genuensis* Porro, and *H. etrusca* Lessona are given as identical, Lessona quoting the dimensions as 30 mill. in diam., and 20 mill. in alt.

In the larger specimens, especially of the gigantic continental varieties, the sculpture of the shell becomes strongly scrobiculate, and presents a very different aspect to the simple striation of the ordinary British form.

Bouchard-Chantreaux has observed that shells obtained from the cliffs about Boulogne are unusually fine, being nearly twice the size of specimens found elsewhere in the district.

In many places on the west coast of Ireland, as at Valentia and on the Aran Isles, there is, according to Dr. Scharff, a race of very large forms.

ENGLAND AND WALES.

Somerset N.—Cheddar Cliffs, Aug. 1883 ! J. Madison. Burnham sandhills, Blagdon, and Weston-super-Mare, E. W. Swanton.

Dorset—East Lulworth, Gadcliff, and Tynham, J. C. Mansel-Pleydell.

Hants. S.—Winchester, J. R. le Brockton Tomlin.

Isle of Wight—Near Yarmouth, Charles Ashford.



FIG. 362.—Aran Islands, Galway West, the celebrated haunt of *Helix nemoralis* var. *major* Fér. (Photo. by Mr. R. Welch).

The bare limestone areas of these islands, with their deep weathered-out "grikes," or fissures, wherein the true maidenhair fern grows in profusion, and which also shelter the giant race of *Helix nemoralis* which these islands are famous for.

Berks.—Maidenhead, 1880, Lionel E. Adams.

Gloucester E.—Cooper's Hill, Cheltenham, E. Simpson. Gloucester, A. G. Stubbs.

Gloucester W.—Paddy's lane near Bristol, J. W. Cundall.

Lincoln N.—Mablethorpe sandhills, 1889; and Hubbard's Valley, Louth, 1900, C. S. Carter.

Derby—Smeine near Winster, and Youlgreave, Rev. H. Milnes.

Notts.—Not uncommon in the county, B. Sturges Dodd.

Lancashire Mid—Specimens labelled "Blackpool" in Blackpool Public Museum !

York S.W.—Chevet near Wakefield, rare, J. Hebden.

York Mid W.—Boston Spa, John Emmet.

SCOTLAND.

Scotland—Dr. Buchanan White says this form is not so common as the type in that country (Scott. Nat., 1873, p. 166).

IRELAND.

Leitrim—Old graveyard near Kinelough, July 1900, R. Welch.

Sligo—Sligo, E. Collier.

Galway W.—Aran Islands (W. Thompson, Annals Nat. Hist., 1840, p. 206).

Clare—Inishmurry Island, Sept. 1900, R. Welch. Ballyvaughan, Aug. 1894, E. Collier.

Waterford—Tramore, G. Barrett-Hamilton.

Kerry—Valentia Island, R. Welch.

FOREIGN DISTRIBUTION.

Germany—Recorded from Oldenburg by von Heimbürg; by Sandberger from Würzburg, Lower Franconia; from Alsace by Meyer; and from Geisenheim, Nassau, by Mrs. Fitzgerald.

France—Var. *major* recorded by Moquin-Tandon from Eaux Bonnes, Hautes Pyrénées, and from Ariège; by Wattebled from Bois de Flagey, Auxonne, Côte d'Or (J. of C., 1889, p. 318); not common in Haute Loire and about Paris (Pascal, l.c.); Tarascon and Ax, Ariège, May 1889! W. Eagle Clarke; and cited by Bouillet from Billom, Puy-de-Dôme. Not uncommon in the Oise at Rantigny; on the limestone hills at Coincourt, Mouy, and very large examples, 30 mill. in diam., on Baudron, a lofty pure limestone hill at Bury. In Pyrénées Orientales equally large shells are found in the Valley of Carol (Baudon, l.c.); and on Pic-de-Montlas, Hautes Pyrénées, by Gourdon.

Sub-var. *gallica*, South of France (Westerlund, l.c.).

Sub-var. *maxima*, recorded by Dumont and Mortillet from Chambéry, Savoy; and as not uncommon amongst var. *media* about Puya near Annecy, Upper Savoy.

Sub-var. *gigantea* is cited by its author for Ariège and Auvergne.

Sub-var. *magna* by Stabile from the Pyrénées.

Italy—Sub-var. *lucifuga* is recorded by Hartmann for Upper Italy.

Sub-var. *appennina* is found in many localities on the northern slope of the Appenines in Piedmont, according to Strobel; and is common about Perugia, Umbria, according to Prof. Bellucci.

Sub-var. *magna* is cited by Stabile from the Appenines near Genoa.

Sub-var. *etrusca* is recorded for many localities in Emilia and Tuscany.

Switzerland—Var. *major*, Vevey, Miss Richardson; and sub-var. *maxima*, Lausanne, Vaud (Charpentier, l.c.).

Portugal—Coimbra, diam. 27 mill. ! A. Nobre.

United States—Lexington, Virginia, diam. 28½ mill., Prof. Morrison (Cockerell, Brit. Nat., 1893, p. 82).

Var. *minor* Moquin-Tandon.

Helix nemoralis var. *parva* Stabile, Conch. Lugano, 1846, p. 23.

Helix nemoralis var. *minor* Moquin-Tandon, Hist. Moll., 1855, ii., p. 162.

Helix nemoralis var. *cisalpina* Stabile, Moll. Piem., 1864, p. 65.

SHELL smaller, and not exceeding 16 mill. in diameter.

The var. *parva* is described as more globose in form, and as 18 mill. in diameter and 16 mill. in altitude, but is scarcely worthy of separation from the type form.

The sub-var. *minor* of Baudon is described as 12–13 mill. in diameter.

The sub-var. *cisalpina* is described as small, with dark aperture.

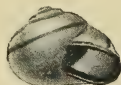


FIG. 363.—*Helix nemoralis* var. *minor* Moq. (Blaxhall, Mr. G. T. Rope).

ENGLAND AND WALES.

Channel Isles—Very small specimens frequent on the cliffs and downs by the sea (Tomlin and Marquand, l.c.). Sub-var. *olivacea*, 02300, diam. 14 mill., Sark, July 1908! F. H. Sikes.

Devon S.—Alphington and Kingsbridge, E. D. Marquand.

Somerset N.—Sand dunes, Burnham and Bristol, E. W. Swanton.

Kent W.—Woolwich, diam. 15 mill., Sept. 1891, L. E. Adams.

Surrey—Prestwick, E. W. Swanton. Reigate, Rev. R. A. Bullen.

Suffolk E.—Banks of river Alde, near Blaxhall, June 1886 ! G. T. Rope.
 Norfolk E.—Alpington, Rev. S. Spencer Pearce. Earlham, St. Faith's, and Hethersett, A. Mayfield.
 Norfolk W.—Sandhills, Hunstanton, Oct. 1894 ! T. Petch.
 Northampton—Great Houghton, 1892, L. E. Adams.
 Gloucester E.—Gloucester, A. G. Stubbs.
 Gloucester W.—Bristol specimens in Bristol Museum !
 Pembroke—Tenby, C. Jeffreys ; Gurfreston, A. G. Stubbs.
 Lincoln N.—Kettleby Beck, Cadney, Jan. 1905 ; and Irby on Humber, Sept. 1902, C. B. Parkes. Louth and South Reston, C. S. Carter.
 Notts.—Thrumpton, B. Sturges Dodd.
 Derby—Matlock, J. A. Howe. Miller's Dale ! E. Collier.
 Lancashire Mid—Specimens labelled "Blackpool" in Blackpool Public Museum.
 York S.E.—Flamborough Head, May 1886 ! W. Denison Roebuck. Brough, Hedon, and Spurn, T. Petch.
 York S.W.—Rather common, Stanley, near Wakefield, J. Hebden.
 Northumberland S.—Coast near Monksheaton, Sept. 1885 ! H. E. Craven.

SCOTLAND.

Dumfries—Moffat, 1886 ! J. Madison.
 Roxburgh—Hawick, R. Cairns.
 Haddington—North Berwick, Rev. Dr. McMurtrie.
 Fife—Isle of May, J. A. Harvie-Brown.
 Perth Mid—Balgowan, Dr. F. Buchanan White
 Ebudes N.—Isle of Eigg, near the sea, Rev. Dr. McMurtrie.

IRELAND.

Down—Newcastle, R. Welch.
 Donegal—Exceedingly small, from the coast dunes near Bunbeg, A. W. Stelfox.
 Sligo—Sligo, E. Collier.
 Kerry—A remarkably small race about Derrynane Bay, south of Valentia, Sep. 1892 ! R. Scharff.

CONTINENTAL DISTRIBUTION.

Germany—Reported from Alsace by F. Meyer.
 France—Common in gardens, Auxonne, and Dôle, Côte d'Or (Wattebled, Journ. de Conch., 1889, p. 318). Reported from Cussac, Haute Loire, by Pascal ; from Bordeaux, Gironde, by Dr. R. F. Scharff ; as common on margin of wood, Augy, Compiègne, Oise, by Dr. Baudon ; by Moquin-Tandon from Toulouse, Haute Garonne ; Lyons, Rhône ; Sorèze, Tarn ; Puy-de-Dôme ; and Ariège ; and by M. H. Cardot from the Meuse.
 Italy—The sub-var. *parva* recorded from Lugano, Lombardy, by Stabile, and from the province of Como by Porro. The sub-var. *cisalpina* is recorded by Lessona as commonly found on the southern and eastern slope of the Alps ; and is also quoted from many localities in Lombardy.

VARIATIONS IN SUBSTANCE OF SHELL.

Var. *ponderosa* Malm.

Helix nemoralis var. *ponderosa* Malm, Göteb. Handl., 1851, ii., p. 121.
Helix nemoralis var. *creticola* Mörch, Syn. Moll. Dan., 1864.
Helix nemoralis var. *cretacea* Baudon, Journ. de Conch., 1884, p. 235.
Helix (Pentatænia) tonnensis Sandberger, Vorwelt, 1875, p. 927, pl. 35, f. 38.
Helix nemoralis var. *hibernica* Westerlund.



FIG. 364.

FIG. 364.—*Helix nemoralis* var. *ponderosa* Malm (Dog's Bay, Roundstone, Galway). Weight of section, 43 grains.

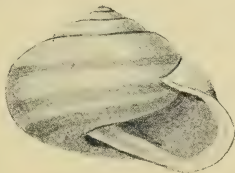


FIG. 365.

FIG. 365.—*Helix tonnensis* Sandberger (Burgtonna, Thuringia, after Sandberger).

The var. *ponderosa* has been described as very thick shelled, whitish, yellowish beneath, with white aperture and rib.

The sub-var. *creticola* is very thick-shelled and ponderous, white, yellowish beneath, with broad fuscous bands, umbilicus often open. Diam. 30 mill. A minor form is described as cretaceous, with broad liver-coloured bands.

The sub-var. *cretacea* is thick and heavy, usually with exfoliated epidermis.

The sub-var. *tonnensis*, *Helix* (*Pentatania*) *tonnensis* is described by Sandberger as "T. globoso-conica, apice obtusa, mammillata, basi imperforata, prope columellam impressa, anf. 5, paullo convexi, suturis linearibus disjuncti, costulis transversalibus tenuibus depressis paullo distantibus et (sub lente) rimulis longitudinalibus confertis ornati, ult. fusco-trifasciatus, antice deflexus et ad aperturam leviter constrictus circiter 4/7 omnis altitudinis æquat. Apert. obliqua, late lunata, marginibus callo tenui junctis, expansis, basali stricto latiore, appresso, columellari postice dilatato, umbilicum obtegente. Alt. 22, lat. 30 mill." He also alludes to it as intermediate between the large *Helix nemoralis* and the Caucasian *Helix atrolabiata*.

Dr. Scharff has, however, submitted specimens of the thick and heavy Holocene shells of the var. *ponderosa* from Dog's Bay, Galway, to Herr Clessin, who regards them as identical in every respect with *Helix tonnensis*.

ENGLAND AND WALES.

Kent W.—Dartford (H. Leslie, Quart. Journ. of Conch., 1874, p. 34).

Glamorgan—St. Fagan's, Cardiff, weight 30 grains, F. W. Wotton.

Pembroke—Tenby burrows, large and thick shells, A. G. Stubbs.

York N.E.—In a small chalk-pit near Binnington, J. A. Hargreaves.

IRELAND.

Ireland—Sub-var. *creticola-minor*, White Strand, Billicarberhy (Westerlund, l.c.).

Donegal—Sub-var. *hibernica*, Bundoran, Dr. Roediger. Mr. R. Welch has found very heavy shells in the living state about Bunbeg, Carrickfin, Horn Head, Maghery and Bundoran.

Galway W.—Formerly plentiful in the fossil state in the "Black Band" deposit at Dog's Bay, Roundstone, where it was discovered by Mr. R. D. Darbishire, of Manchester, but now found in a much lower zone in a stratum of clean sand, foraminifera and finely comminuted shells; the shells now found in the "Black Band" above being of ordinary substance (see p. 286, f. 344).

CONTINENTAL DISTRIBUTION.

France—Sub-var. *cretacea* recorded by Baudon from limestone quarries in the Oise; and as rather common in hedges, Villers-les-Pots, Auxonne, Côte d'Or, by Watebled.

Sweden—Var. *ponderosa* recorded by Dr. Westerlund from Benestad, Skane, and the sub-var. *creticola* from Sweden without precise locality.

Denmark—Sub-var. *creticola* in the Island of Møen (Westerlund, l.c.).

Var. *pellucens* Moquin-Tandon.

Helix nemoralis var. *diaphana* Grateloup, Catal. Moll. France, 1855, p. 5.

Helix nemoralis var. *pellucens* Moquin-Tandon, Hist. Moll., ii, 1855, p. 162.

Helix nemoralis var. *tenuis* Baudon, Journ. de Conch., 1884, p. 235.

The sub-var. *pellucens* is very small and transparent.

The sub-var. *tenuis* is almost transparent and said to live in very moist woods.

ENGLAND AND WALES.

Cornwall W.—Sub-var. *tenuis*, Truro and Falmouth, 1886, J. H. James.

Devon N.—Sub-var. *tenuis*, many specimens, all with modified typical fasciation, Ilfracombe, also found at Lynton, Aug. 1903, H. Beeston and C. E. Wright.

Norfolk E.—One at Yelverton, Rev. S. Spencer Pearce.

Stafford—Sub-var. *castanea*, Aug. 1890 ! Lionel E. Adams.

Lincoln N.—Hundleby, July 1904, C. S. Carter. Nettleton, July 1901 ! Miss Allott.

IRELAND.

Antrim—Cushendun, May 1886 ! Rev. S. A. Brenan.

Down—South end of sand dunes, Newcastle, average weight 4 grains, R. Welch.

Donegal—In damp woods, Glenveigh, A. W. Stelfox.

Clare—Ballyvaughan, Aug. 1894 ! E. Collier. Ennistimon, in wet moss on shales, 1907 ! P. H. Grierson.

Kerry—Very thin on Great Skellig, Sept. 1888, Rev. A. H. Delap. On the shale at the summit of Magillicuddy Reeks the shells were so thin as to crush between the fingers when gathered, J. Ray Hardy.

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *pellucens*, recorded from Alsace by Meyer.

France—Sub-var. *tenuis*, Oise (Baudon, l.c.). Recorded from the Pyrénées by Dr. Grateloup; by Pascal from Bois de Jacques, Enghien, near Paris; and by Moquin-Tandon from the lofty mountains near Clermont, Puy-de-Dôme, and Eaux Bonnes, Hautes Pyrénées.

VARIATION IN SCULPTURE OF SHELL.

Var. subaustriaca Bourguignat.

This variety is described by M. Margier as distinguished by its somewhat distinctly striate shell.

CONTINENTAL DISTRIBUTION.

France—Recorded by Margier from Grande Chartreuse, near Grenoble, Isère, and as commonly found of a large size in a somewhat moist wood, Basses Alpes.

VARIATIONS IN COLOUR OF SHELL.

The section to which the uniformly coloured shells belong has been distinguished by Moquin-Tandon (*Hist. Moll.*, 1855, p. 162), as var. *unicolor*; by Picard (*Moll. Somme*, 1840, p. 183) as var. *concolor*; and by Albin Gras (*Moll. Isère*, 1840, p. 29) as var. *infasciata*; it embraces all unicolorous unbanded shells and all shades of colouring. It also includes the *Helix nemoralis* of Sheppard, who regarded the unicolorous as specifically distinct from the banded forms.

Var. albina Moquin-Tandon.

Helix nemoralis var. *albescens* Picard, *Moll. Somme*, 1840, p. 184.

Helix nemoralis var. *albina* Moquin-Tandon, *Hist. Moll.*, 1855, ii., p. 162.

Helix nemoralis var. *alba* Baudon, *Moll. Oise*, 1862, p. 19.

Helix nemoralis var. *pseudo-albina* Locard, *Mal. Lyonn.*, 1877, p. 30.

Helix nemoralis var. *albescens* Cockerell, *Nat. World*, 1885, p. 1.

Helix nemoralis var. *purpurascens* Cockerell, *op. cit.*, p. 235.

Helix nemoralis var. *virescens* Westerlund, *Syn. Moll. Extram.*, 1897, p. 57.

The var. **albina** of Moq. (but not *albinos* of Charpentier) is described as white.

The sub-var. *albescens* of Picard is yellowish-white or whitish; the *albescens* of Cockerell and the subsequently differentiated var. *purpurascens* of the same author are whitish or yellowish-white with a tinge of purplish or purplish-brown on the last whorl near the aperture.

The var. *virescens* Westerlund, which has been described by Prof. Cockerell as being of a pale greenish tinge, white at the sutures, and with a white lip, may be regarded as an interesting modification of the var. *albina*.

The sub-var. *pseudo-albina* is whitish with a very clear grey band.

It is also the var. *albida inornata*, var. *leucostoma albida inornata*, and the *albida quinquefasciata* of Pirona.

Albine shells are, according to Dumont and Mortillet, exclusively found at Meylan near Grenoble, Isère, and the same feature quite predominates on the more lofty parts of the banks of the river Arve in Upper Savoy.

As modifications of the albine form may be registered the following band variations which have been distinguished and named:—

12345	var. <i>bornea</i> Moq.	10345	var. <i>chemnitzia</i> Moq.
123(45)	var. <i>durostia</i> Locard.	000::	var. <i>quattieria</i> Moq.
::::	var. <i>milleria</i> Moq.	00300	var. <i>rissoa</i> Moq.

Mr. J. Hawkins, of York, has recorded that out of forty-six examples found upon coltsfoot (*Tussilago farfara*), thirty-two were white, and that the specimens, both of *H. nemoralis* and *H. hortensis*, found living on the ash (*Fraxinus excelsior*) are principally pale coloured.

ENGLAND AND WALES.

Devon N.—Braunton, Aug. 1903, H. Beeston and C. E. Wright.

Wilts. N.—Marlborough (Bromehead), E. W. Swanton.

Sussex E.—Lewes, C. H. Morris.

Kent W.—Sub-var. *albescens*, Wrotham, Aug. 1884, T. D. A. Cockerell.

Kent E.—Folkestone, very rare, Sept. 1877, Mrs. Fitzgerald.

Surrey—Haslemere, C. Pannell, junr.

Northampton—Blisworth, Oct. 1905, Rev. W. A. Shaw. Sub-var. *alba*, Woodford. C. E. Wright.

Glamorgan—Var. *albina* and sub-var. *purpurascens*, Cardiff, 1889 ! F. W. Wotton.

Pembroke—Sub-var. *purpurascens* 00300, North Cliff, Tenby, A. G. Stubbs.

Merioneth—Barmouth, 1:345, J. Kidson Taylor.

Lincoln N.—Wyham and Mablethorpe sandhills, 1900; and Hubbard's Valley, Louth, Aug. 1901, C. S. Carter.

Cheshire—Sale, (123)(45). J. Kidson Taylor.

Lanc. S.—Southport, (12)345; Chorlton, 12345, J. Kidson Taylor.

York S.E.—Barlby near Selby, June 1890 ! W. Nelson.

IRELAND.

Antrim.—Ballycastle, 00300, J. Kidson Taylor.

Donegal.—Bunbeg, (123)45 and 12345, J. Kidson Taylor.

Dublin—Sub-vars. *viridescens* 12345 and *purpurascens*, Dublin, 1885, J. R. Redding.

Sligo.—(1234)5, J. Kidson Taylor.

Clare—Sub-var. *albescens*, Ballyvaughan, Aug. 1894, E. Collier.

Tipperary S.—Sub-var. *viridescens*, near Clonmel, Rev. A. H. Delap.

Cork S.—Carrigaline Castle, May 1888 ! W. F. de Vismes Kane.

FOREIGN DISTRIBUTION.

Germany—Recorded from North Germany by A. Schmidt; from Carlsruhe, Baden, by Gysser; and from Alsace by Meyer.

France—Var. *albina* 00000, with the banded sub-vars. 12345, 10345, 00300, and 000:: Digne, Basses Alpes, and :::: Boulogne-sur-Mer, Pas-de-Calais (Moquin-Tandon, l.c.); Arcueil-Cachan, Seine (Pascal, l.c.); Ariège (Grateloup); Salies de Béarn, Basses Pyrénées, 1903, Hugh Watson; and Royan, Charente Inférieure, by Desmoulins.

Sub-var. *alba*, Mouy, Oise (Baudon, l.c.).

Sub-var. *albescens*, recorded by Locard from Lyons, Rhône, and Colombier, etc., Ain; and from the department of the Somme by Picard.

Sub-var. *pseudo-albina*, rare at Place St. Clair, Lyons (Locard, l.c.).

Switzerland—Near Geneva (Brot, Proc.-Verb. Soc. Mal. Belg., 1877, p. xlviii.).

Italy—Sub-vars. *albida inornata*, *leucostoma albida inornata* and *albida quinquefasciata* are cited from Udine, Venetia, by Prof. Pirona.

Austro-Hungary—Recorded from the South Tyrol by J. and P. Strobel.

United States—Sub-var. *albescens*, Lexington, Virginia, Prof. Morrison.

Var. *libellula* Risso.

Helicogena libellula Risso, Hist. Nat. Eur. Mérid., 1826, p. 62, no. 134.

Helix nemoralis vars. *flava*, *lutescens*, and *flavovirescens* Picard, Moll. Somme, 1840, p. 183.

Helix nemoralis var. *sulfurea* Grateloup, Cat. Moll. France, 1855, p. 9.

Helix nemoralis var. *lutea* Baudon, Journ. de Conch., 1884, p. 234.

Helix nemoralis var. *aurantia* Cockerell, Nat. World, 1885, p. 144.

Helix nemoralis var. *libellula-purpurascens* Cockerell, op. cit., p. 235.

Helix nemoralis var. *fallax* Cockerell, Sci. Goss., 1887, p. 177.

The var. *libellula*—var. *lutea* of Baudon, var. *lutea inornata* of Pirona, and var. *unicolor lutea* of Dumont and Mortillet—embraces all the shells in which the ground colour is any shade of yellow, and is co-extensive in its geographical distribution with the species itself.

The sub-var. *flava* is of a very beautiful, brilliant, and pure yellow.

The sub-var. *lutescens* is pale yellow. The sub-var. *fallax* Ckll., is also "pale yellow, but appears green when occupied by the animal. It is a sub-variety of *libellula*."

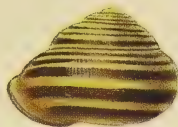
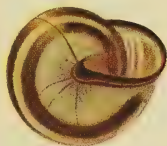
The sub-var. *flavovirescens* is of a greenish-yellow.

The sub-var. *aurantia* is orange coloured and almost intermediate in shade between vars. *libellula* and *rubella*.

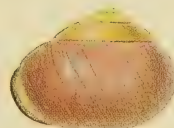
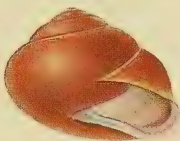
The sub-var. *libellula-purpurascens* is described as yellow, flushed with purplish or brownish-purple on the last whorl near the aperture.

Leydig remarks on the influence of light, warmth and dryness as distinctly evidenced by the fine citron-yellow shells of this species found in the sunny vineyards of the Main Valley. Specimens of large size and of a beautiful yellow are recorded by Mr. J. Hawkins as found on the willow-herb (*Epilobium hirsutum*).

HELIX NEMORALIS L.



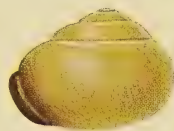
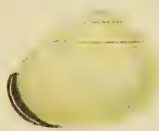
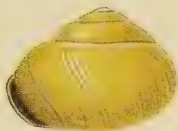
Helix nemoralis Linné.
Truro, J. H. James.



H. nemoralis v. *rubella* Picard.
Valentia Island, E. Collier.

H. nemoralis v. *rubra* Baudon.
Lisdoonvarna Spa, E. Collier.

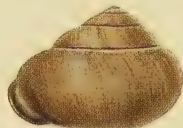
H. nemoralis v. *rosea* Baudon.
Knottingley, J. Cordukes.



H. nemoralis v. *libellula* Risso.
Valentia, E. Collier.

H. nemoralis s.v. *albescens* Pic.
Ballyvaughan, E. Collier.

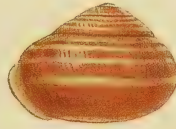
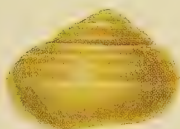
H. nemoralis v. *flavovirescens* Pic.
Bristol, Miss Hele.



H. nemoralis v. *studeria* Moq.
Castleton, G. H. Taylor.

H. nemoralis v. *olivacea* Risso.
Limerick, E. Collier.

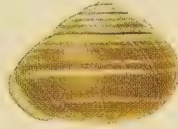
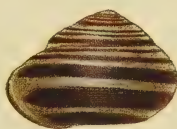
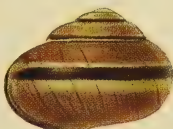
H. nemoralis v. *castanea* Picard.
Blagdon, Miss Hele.



H. nemoralis v. *citrinizonata* Ckll.
Carrickfin, E. Collier.

H. nemoralis v. *hyalozonata* Taylor.
Carrickfin, E. Collier.

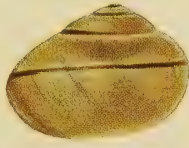
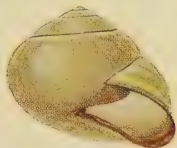
H. nemoralis v. *lateritia* D. & M.
Blagdon, Miss Hele.



H. nemoralis v. *fasciata* Picard.
Barnsley, W. E. Brady.

H. nemoralis s.v. *mista* B. & B.
Hereford, Dr. Boycott.

H. nemoralis v. *olivaceozonata* Coll.
Magilligan, E. Collier.



H. nemoralis v. *roseolabiata* Koh.
Bath, Miss Hele.

H. nemoralis s.v. *tenuis* Baudon.
Ennistimon, P. H. Grierson.

H. nemoralis v. *rubello-libellula* Ckll.
Bordeaux, R. F. Scharff.

As modifications of this variety may be enumerated var. *lutea quinquefasciata* of Pirona and the following band variations to which distinctive names have been applied:—

1 2 3 4 5	var. <i>quinquefasciata</i> Moq.	1 0 0 4 5	var. <i>sionnestia</i> Locard.
1234445	var. <i>morrisonia</i> Cockerell.	0 2 0 4 5	var. <i>pascalina</i> Locard.
(12345)	var. <i>kleinia</i> Moq.	0 0 3 (45)	var. <i>gmelinia</i> Moq. if the third band is visible on the upper whorls, but var. <i>souleyetia</i> Moq. when present on body-whorl only.
1 (2345)	var. <i>wartelia</i> Moq.	0 0 3 : 5	var. <i>turtonia</i> Moq.
(123)(45)	var. <i>gronovia</i> Moq. and the var. <i>lortetia</i> Locard.	0 0 : 4 5	var. <i>donovania</i> Moq.
(123)(45)	var. <i>poiretia</i> Moq.	0 0 3 ::	var. <i>dumontia</i> Locard.
1(23)(45)	var. <i>brardia</i> Moq.	0 : 0 : 5	var. <i>bourguignatia</i> Locard.
(123)45	var. <i>nilssonina</i> Moq.	0 0 ::	var. <i>elosia</i> Moq.
1(23)45	var. <i>woodia</i> Moq.	::: 0 0	var. <i>jourdainia</i> Locard.
123(45)	var. <i>reamuria</i> Moq.	0 2 3 0 0	var. <i>fremingvillea</i> Locard.
1 : 3 4 5	var. <i>adansonina</i> Moq.	0 0 3 4 0	var. <i>brotia</i> Locard.
: 2 3 4 5	var. <i>blainvillia</i> Moq.	0 0 0 4 5	var. <i>biguetia</i> Moq.
:: 3 4 5	var. <i>fischeria</i> Locard.	0 0 0 (45)	var. <i>chantrea</i> Locard.
((::)::)	var. <i>courtia</i> Locard.	1 0 3 0 0	var. <i>roya</i> Locard.
: ::::	var. <i>mulleria</i> Moq.	0 0 3 0 5	var. <i>bruguiera</i> Moq.
0 2 3 4 5	var. <i>schroeteria</i> Moq.	0 0 :: 0	var. <i>hutchinsia</i> Moq.
1 0 3 4 5	var. <i>argenvillea</i> Moq.	0 0 3 0 :	var. <i>crossea</i> Locard.
1 2 0 4 5	var. <i>favannea</i> Moq.	0 0 0 : 5	var. <i>gaudrya</i> Locard.
0(2345)	var. <i>dorthesia</i> Moq.	0 0 0 (:5)	var. <i>fuchsia</i> Locard.
02(345)	var. <i>lamarekia</i> Moq.	0 0 0 ::	var. <i>moquinia</i> Locard.
(12)0(45)	var. <i>falsania</i> Locard.	0 0 3 0 0	var. <i>cuvieria</i> Moq. if the band is visible on the upper whorls, but var. <i>boysia</i> Moq. when present on body-whorl only.
103(45)	var. <i>gassiesia</i> Locard.	0 0 : 0 0	var. <i>repellina</i> Locard.
: 0 3 4 5	var. <i>tournouria</i> Locard.	0 0 0 0 5	var. <i>dillwynia</i> Moq.
: 0 3 : 5	var. <i>leufroya</i> Moq.		
0 : :::	var. <i>pacomea</i> Locard.		
: 0 :::	var. <i>desoria</i> Locard.		
1 2 3 0 0	var. <i>lacroixia</i> Locard.		
0 0 3 4 5	var. <i>listeria</i> Moq. when the third band is visible on the upper whorls, but the var. <i>rumphia</i> Moq. when present on body-whorl only.		

ENGLAND AND WALES.

Channel Isles—Common (J. R. le B. Tomlin and E. D. Marquand, l.c.).

Devon S.—Alphington, E. D. Marquand.

Devon N.—Sub-var. *aurantia*, Ilfracombe, usually 00000, 00300, Aug. 1903 (H. Beeston and C. E. Wright).

Kent E.—Deal sandhills, Rev. J. W. Horsley. Folkestone, very rare, Mrs. Fitzgerald.

Kent W.—Sub-vars. *aurantia*, *lutescens*, and *fallax*, on an ivy-covered bank, Crayford, T. D. A. Cockerell.

Gloucester E.—Gloucester, A. G. Stubbs.

Hereford—Sub-var. *lutescens*, Hereford, Oct. 1886 ! C. B. Plowright.

Pembroke—Sub-var. *libellula purpurascens*, North Cliff, Tenby, A. G. Stubbs.

Lancashire S.—Sub-var. *aurantia*, Burnley, Aug. 1887, J. Russell Wildman.

IRELAND.

Tipperary N.—Sub-var. *flavovirescens*, Borrisokane, Aug. 1907 ! R. A. Phillips.

Tipperary S.—Sub-var. *aurantia*, near Clonmel, Rev. A. H. Delap.

Waterford—Sub-var. *flavovirescens*, near Clonmel, Rev. A. H. Delap.

FOREIGN DISTRIBUTION.

Germany—Sub-var. *aurantia* recorded from North Germany by A. Schmidt ; and by Dr. Jordan from Landskrone near Gorlitz, Silesia.

Sub-var. *lutescens* from Suabian Alb, Wurtemberg, by Dr. Weinland.

France—Sub-var. *sulfurea* is, according to Grateloup, found throughout France and Corsica.

Sub-var. *flava* is recorded by Moquin-Tandon from Toulouse, Haute Garonne ; Lyons, Rhône ; Ariège ; and the Pyrénées ; and by Putoin from the Vosges.

Sub-var. *lutescens* is recorded from Eaux Bonnes in Hautes Pyrénées, and Sorèze in the Tarn by Moquin-Tandon ; and from Lille, Nord, by M. Norguet.

Sub-var. *fallax*, Cabourg-sur-Mer, Calvados (Cockerell, l.c.).

Sub-var. *flavovirescens* is reported from Toulouse by Moquin-Tandon.

Sub-var. *lutea* is noted from Mouy, Oise, by Dr. Baudon.

Sub-vars. *flava*, *lutescens*, and *flavovirescens* are all described by Picard from specimens found in the department of the Somme.

Sub-var. *rubello-libellula* reported from Bordeaux, Gironde, by R. F. Scharff.

Italy—Var. *libellula* is recorded from Lugano, Lombardy, by Stabile. Sub-vars. *lutea inornata* and *lutea quinquefasciata* are cited by Prof. Pirona from Udine, Venetia; and sub-var. *lutescens* was found at Menaggio, Lombardy, in 1886, by Mr. J. R. le B. Tomlin.

Portugal—Sub-var. *lutea*, common, Coimbra, Ang. Nobre.

Norway—Sub-var. *lutea* recorded for Bergen by Miss Esmark.

Russia—Recorded from Volhynia by Krynicki.

United States—Var. *libellula* recorded from Lexington, Virginia by Prof. J. L. Howe, who enumerates 291 band-variations, of which the great part are multiple-banded forms; sub-var. *aurantia* 00000 is also recorded.

Prof. T. D. A. Cockerell has also recorded the formula 00300 from Burlington, New Jersey, collected by Mr. W. G. Binney.

Var. *rubella* Picard.

Helix nemoralis var. *rubella* Picard, Moll. Somme, 1840, p. 184.

Helix nemoralis vars. *rubra*, *rosea*, and *carnea* Baudon, Moll. Oise, 1884, p. 234.

Helix nemoralis var. *libellulo-rubella* Cockerell, Nat., 1889, p. 320.

Helix nemoralis var. *incarnata* Westerlund, Syn. Moll. Extram., 1897, p. 57.

The var. *rubella* is described as of a delicate rose or yellowish-rose colour.

The sub-vars. *rubra*, *rosea*, and *carnea* are held by their author to possess names sufficiently descriptive of their various shades of colouring.

The sub-var. *libellulo-rubella* Cockerell has the "apex of the shell yellow, body whorl pink."

It is also the var. *rosea unicolor* of Pirona.

As subsidiary modifications of the var. *rubella*, the var. *rosea quinquefasciata* 12345 and var. *rosea bifasciata* (123)(45) and 0(23)(45) of Pirona and the following band variations are distinguished by continental authors:—

1 : 3 4 5	var. <i>bonnania</i> Moq.	0 0 3 0 0	var. <i>guettardia</i> Moq. and
0 : : : :	var. <i>duguea</i> Moq.		var. <i>gaertnera</i> Moq.
0 0 : 4 5	var. <i>fournelia</i> Locard.	0 0 0 0 5	var. <i>moussonia</i> Locard.
1 0 0 0 5	var. <i>sarsia</i> Locard.		

ENGLAND AND WALES.

Channel Isles—Common on the islands; sub-var. *carnea*, one specimen at Vazon, Guernsey (Tomlin and Marquand, l.c.).

Cornwall W.—Newquay and Truro, J. H. James. St. Austell, J. Kidson Taylor.

Devon S.—Common near Exeter; sub-var. *carnea* occasional, E. D. Marquand. Sub-var. *libellulo-rubella*, Kingsbridge, G. D. H. Carpenter.

Devon N.—Ilfracombe, J. R. le B. Tomlin.

Somerset N.—Sub-var. *carnea*, Burnham and other places, E. W. Swanton. Minehead, Lionel E. Adams.

Wilts. N.—Marlborough (Bromehead), Devizes, Miss Cunningham. Stourton, Mere, Edington, etc., E. W. Swanton.

Hants. S.—Sub-var. *carnea*, Christchurch, C. Ashford.

Hants. N.—Preston Candover, Rev. H. P. Fitzgerald.

Kent W.—Maidstone, H. Elgar and H. Lamb.

Surrey—Prestwick, E. W. Swanton. Haslemere, C. Pannell, junr.

Suffolk E.—Ipswich, Claude Morley.

Suffolk W.—Great Fakenham; Redgrave, Mildenhall; and Walsham-le-Willows, A. Mayfield.

Norfolk E.—Fairly common, Rev. S. S. Pearce and A. Mayfield.

Cambridge—Fine about Cambridge, D. Dyson. Whittlesey, H. J. Bellars.

Northampton—Not uncommon, L. E. Adams. Sub-var. *carnea*, Grimscoote ! A. Loydell; and Peterborough ! T. W. Bell.

Gloucester E.—Fine at Cheltenham, D. Dyson. Gloucester, A. G. Stubbs.

Worcester—Var. *rubella*, Crossway Green and Wildon; sub-var. *carnea*, Stourport and Wildon, J. W. Williams.

Glamorgan—Not uncommon, Cardiff, F. W. Wotton. Var. *rubella* and sub-var. *carnea*, Penally, H. R. Wakefield.

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OF THE
BRITISH ISLES.

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OF THE
BRITISH ISLES.

JOHN W. TAYLOR.

233622

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Published June 17, 1911.



**PART 19 will treat upon *Helix pisana*,
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- Pembroke**—Giltar Point and Gurfreston, J. Kidson Taylor.
Cardigan—Garden, Aberayron, May 1888 ! Miss Maddy.
Merioneth—Craig Abermaw and Mochras, Aug. 1884 ! J. Hopkinson.
Carnarvon—Bangor, D. Dyson. Capel Curig, 1887 ! J. Madison. Locally dominant,
 Bettws-y-coed, C. Ashford. Great Orme's Head, 000(45), Aug. 1906, C. E. Wright.
Anglesey—Fine about Beaumaris, D. Dyson.
Lincoln S.—Hammond Beck bank, Gosberton, Aug. 1888 ! H. Wallis Kew.
Lincoln N.—Var. *rubella*, Ropsley, Oct. 1907 ; Mablethorpe and Washingborough,
 Sept. 1908 ; also sub-var. *carnea*, Bardney, Dec. 1905 ! J. F. Musham.
Derby—Dovedale, 1892 ! F. Collier. Sub-v. *carnea*, Miller's Dale, 1873, T. Glover.
Cheshire—Sale, J. Kidson Taylor.
Lancashire S.—Moderately common about Burnley, Aug. 1887, J. R. Wildman.
Lancashire Mid—Canal-side, Bolton-le-Sands, Aug. 1905, H. Beeston.
York S.E.—Near Hull ! F. W. Fierke. Common in Holderness ! Tom Petch.
 Knottingley ! J. Cordukes.
York N.E.—Not uncommon about Scarborough, W. Gygell. Sub-var. *rubra*,
 Strensall Common, May 1881 ! W. Nelson.
York Mid W.—Primrose Valley near Leeds ! W. Nelson.
Cheviotland—Common on south bank of r. Aln, Alnmouth, Rev. Dr. McMurtrie.
Isle of Man—Scarlet Point, E. Collier ; Douglas road, Peel, Aug. 1898, R. Cairns.

SCOTLAND.

- Dumfries**—Moffat, J. Madison. Dumfries ! W. Evans.
Kirkcudbright—Castle Douglas ! W. Evans. Kirkcudbright ! W. Thomson.
Wigtown—Springbank near Stranraer ! W. Evans.
Ayr—Maybole ! H. Nelson. Largs ! A. Shaw. Skelmorlie ! W. Denison Roebuck.
 Var. *rubella*, Ardrossan, and sub-var. *rosea*, Largs, J. Kidson Taylor.
Renfrew—Greenock ! T. Scott.
Lanark—Summerston ! A. Shaw.
Peebles—Neidpath Castle ! W. Evans. Walkerburn ! W. Denison Roebuck.
Roxburgh—Melrose Abbey ! W. D. Roebuck. Near Hawick ! W. G. Guthrie.
Berwick—Fans ! R. Renton. Sub-var. *carnea*, Cockburnspath ! W. Evans.
Haddington—North Berwick, Rev. Dr. McMurtrie. Aberlady ! W. Evans.
Edinburgh—Braid Burn ! W. E. Clarke. Sub-var. *carnea*, Braid Burn ! W. Evans.
Fife—Links, Elie, Aug. 1886 ! and Cupar ! T. Scott.
Stirling—Balmore, Summerston, and Bardowie Loch ! A. Shaw.
Perth Mid—Birnam, Mrs. Carphin. Balgowan ! Dr. Buchanan White.
Perth N.—Dunkeld and Blairgowrie ! W. Evans.
Forfar—Gallie Burn, Dundee ! J. Ramage.
Easternness—Sub-var. *carnea*, Foyers, Loch Ness, Baker Hudson.
Westernness—Foyers, Loch Ness ! Baker Hudson.
Main Argyle—Lismore, J. K. Taylor. Innellan ! Alex. Somerville. Hunter's
 Quay ! W. Denison Roebuck. Sub-var. *carnea*, Loch Eck, T. D. A. Cockerell.
Dumbarton—Cardross ! Rev. H. Friend. Gareloch, Garscadden, Maryhill, and
 sub-var. *carnea*, Duntocher, A. Shaw.
Clyde Isles—Port Bannatyne, Bute ! A. Shaw.
Cantire—Campbeltown ! A. Shaw. Var. *rubella* and sub-var. *carnea*, Old
 Castle, East Loch Tarbert, T. Scott.

IRELAND.

- Antrim**—Larne, J. Kidson Taylor.
Down—Sandhills, Killard Point, Portaferry, Mrs. Russell.
Armagh—Sub-var. *carnea*, Maydown, Benhurle, Aug. 1888 ! Rev. W. Fowler.
Donegal—Var. *rubella* and sub-var. *carnea*, Rathmullen, A. Shaw. Sub-var.
carnea, Waterfoot, J. G. Milne. Sub-var. *rubra*, Bundoran, Dr. Scharff.
King's Co.—Moneygall, June 1906 ! Rev. E. A. Woodruffe-Peacock.
Leitrim—Sub-var. *carnea*, Dromod, J. G. Milne.
Galway W.—Killeany, Aranmore, July 1895, all unbanded, R. Standen.
Clare—Very large, Ballyvaughan, Aug. 1894 ; also var. *rubella*, and sub-vars.
rubra, *rosea*, and *carnea*, Lisdoonvarna, June 1910 ! E. Collier.
Tipperary S.—Clonmel, Rev. A. H. Delap.
Waterford—Cappagh and Dungarvan, Sept. 1888 ! G. Barrett-Hamilton.
Cork S.—Sub-var. *carnea*, Carrigaline, May 1888 ! W. F. de Vismes Kane.
Kerry—Beginnish Island, and Rectory garden, Valentia, Miss Delap.

FOREIGN DISTRIBUTION.

- Germany**—Recorded by Kleeburg from East Prussia ; and from Bad Holwald,
 Alsace ; and Steinach, Thuringia, by Boettger. It occurs at Gremsmühlen, Holstein !
 Sub-vars. *rosea* and *carnea* are cited by A. Schmidt for North Germany ; and
 sub-var. *carnea* for Saxonian Alb by Dr. Weinland.

Belgium—The commonest form at Hasselt, etc., Limburg (Colbeau, l.c.).

Holland—Heerenveen, Friesland, Aug. 1909 ! F. H. Sikes.

France—Var. *rubella* was described by Picard from the Somme; recorded from Lyons and the Ain by Locard; from the Vosges by Puton; from the Pyrénées and Toulouse; with the banded sub-vars. 00300 from the Pyrénées and Digne, Basses Alpes; 12345 from Toulouse and :::: from Grenoble, Isère, by Moquin-Tandon; from Lourdes, Hautes Pyrénées, by F. H. Sikes; from Marvejols, Lozère, by Fagot and Malafosse; and Dieppe, Rouen, and Venues, Seine Inférieure, by S. C. Cockerell.

Sub-vars. *rubra*, *rosea*, and *carnea* are cited from Mouy, Oise, by Baudon.

Sub-var. *carnea*, found at Ax, Ariège, May 1889 ! by W. Eagle Clarke; recorded by Norguet from Valenciennes, Nord; and by Puton for the Vosges.

Switzerland—Var. *rubella* is predominant about Lucerne, F. Roffien.

Austro-Hungary—A rose coloured variety with a dark rose band 00300 recorded by Dr. Boettger from Plischeurtza Mountains, Croatia.

Italy—Sub-vars. *rosea unicolor*, *rosea quinquefasciata*, and *rosea bifasciata* are all cited from Udine, Venetia, by Prof. Pirona.

Spain—Fontarabia, Basque province, Jan. 1910 ! F. H. Sikes. Sub-var. *carnea*, Andorra, May 1889 ! W. Eagle Clarke.

Portugal—Sub-var. *rosea*, rather rare, Coimbra, Aug. Nobre.

Norway—Sub-var. *carnea*, Bergen and Stavanger, Miss B. Esmark.

Russia—Recorded from Volhynia by Krynicki.

United States—Var. *rubella*, recorded by Prof. J. L. Howe from Lexington, Virginia, forty-two band variations being detailed, of which twenty-three were forms bearing supplementary bands (Amer. Nat., 1898, p. 921). Prof. Cockerell records specimens with the formulæ 00000 and 00300 from Burlington, New Jersey; and Mr. H. Prime tetrafasciate and unicolorous specimens from Flushing, New York.

Var. *studeria* Moquin-Tandon.

Helix nemoralis var. *studeria* Moquin-Tandon, Hist. Moll. France, 1855, p. 167.

Helix nemoralis var. *violacea* Baudon, Moll. Oise, 1862, p. 19.

Helix nemoralis var. *purpureo-tincta* Cockerell, Brit. Nat., 1891, p. 65.

Helix nemoralis var. *lilacina* Westerlund, Syn. Moll. Extram., 1897, p. 57.

The var. *studeria* is described as of a lilac colour.

This variety is really a very uncommon shell, and though somewhat frequently found of a lilac colour, the shells are generally denuded specimens of certain forms of vars. *rubella* or *castanea*, which have a purplish ground beneath the epidermis.

The sub-var. *violacea* is described as of a delicate violet colour.

The sub-var. *lilacina* is probably held to possess a name sufficiently descriptive.

The sub-var. *purpureo-tincta* is "very pale purplish, like the var. *pallida* of *H. hortensis*" and is "allied to *f. studeria*."

As subsidiary forms of this variety two band formulæ have been noted and named.

00345 var. *montfortia* Moq.

00300 var. *altenia* Moq.

ENGLAND AND WALES.

Devon S.—Sidmouth, April 1898, Guy Breeden.

Somerset S.—Minehead, July 1900, Guy Breeden.

Sussex E.—Sub-var. *purpureo-tincta*, near Lewes, C. H. Morris (Cockerell, l.c.).

Kent W.—Crayford and Dartford, T. D. A. Cockerell.

Suffolk W.—Sub-var. *lilacina*, Great Fakenham, Mrs. Caton.

Notts.—Sub-var. *lilacina*, Bridgeford, 1892 ! A. G. Stubbs.

York S.E.—A whitish shell, changing to purple on the body-whorl, with a slightly darker purple band, and perhaps best indicated as sub-var. *albo-studeria*, 00300, Barlby, Dec. 1910 ! J. F. Musham.

IRELAND.

Antrim—Sandhills, Portrush, T. H. Hedworth.

Tipperary S.—Clonmel, Rev. A. H. Delap.

FOREIGN DISTRIBUTION.

Germany—A violet-grey variety recorded for North Germany by A. Schmidt.

France—Reported from Salies-de-Bearn, Basses Pyrénées, by Hugh Watson. Recorded by Norguet from Valenciennes, Nord; by Locard from Lyons; by Moquin-Tandon from Tours, Indre-et-Loire; Toulouse, Haute Garonne; and St. Bertrand, Hautes Pyrénées; and by Pascal from Haute Loire and Seine.

The banded form 00300 is reported from North France; and 00345 from Toulouse and the Pyrénées. Sub-var. *violacea* is from Mouy, Oise (Baudon, l.c.).

United States—Sub-var. *purpureo-tincta* 1(23)(45), 123(45), 00300, and 123×(45) recorded by Prof. J. L. Howe from Lexington, Virginia.

Var. **castanea** Picard.*Helix nemoralis* vars. *castanea* and *cornea* Picard, Moll. Somme, 1840. p. 184.*Helix nemoralis* var. *petiveria* Moquin-Tandon, Hist. Moll., 1855, ii., p. 167.*Helix nemoralis* var. *fulvotincta* Cockerell, Brit. Nat., 1891, p. 65.

The var. **castanea** *sensu stricto* is described as of a beautiful dark colour, approaching the colour of the horse-chestnut.

When the epidermis is lost, the shell appears of a pretty but dull rose colour, and that of the sub-var. *petiveria* is often of a distinct lilac.

The sub-var. **cornea** is of a very clear chestnut or clear horn colour.

The sub-var. **petiveria** is described as fawn coloured.

The sub-var. **fulvotincta** is "very pale fulvous, or pinkish-yellow. A pale form allied to var. *petiveria*."

The undernoted band variations have been distinguished by French authors as modifications of the sub-var. *petiveria* :—

1 2 3 4 5	var. <i>brissonia</i> Moq.	1 0 3 4 0	var. <i>tiberia</i> Locard.
(12345)	var. <i>richardia</i> Moq.	1 0 0 4 5	var. <i>montrouzieria</i> Locard.
(123)(45)	var. <i>lowea</i> Moq.	003(45)	var. <i>dugesia</i> Moq.
(12)345	var. <i>draparnaudia</i> Moq.	0 0 3 ::	var. <i>grognotia</i> Locard.
123(45)	var. <i>arcelinia</i> Locard.	0 0 3 : 5	var. <i>mabillea</i> Locard.
(123)45	var. <i>matonia</i> Moq. and	1 : 3 0 0	var. <i>picardia</i> Moq.
	var. <i>veranya</i> Locard.	003(:5)	var. <i>matheronia</i> Locard and
1(23)45	var. <i>goupilia</i> Moq.		var. <i>seringia</i> Locard.
(12)3(45)	var. <i>brookea</i> Cockerell.	0 0 : 4 5	var. <i>forbesia</i> Moq.
: 2 3 4 5	var. <i>boscia</i> Moq.	0 0 :: :	var. <i>lorja</i> Locard.
:: 3 4 5	var. <i>daubebardia</i> Moq.	0 0 :: 5	var. <i>jousseauinea</i> Locard.
:: :: :	var. <i>bonurea</i> Moq.	0 0 3 0 5	var. <i>gabillotia</i> Locard.
1 2 0 4 5	var. <i>michaudia</i> Locard.	0 0 0 4 5	var. <i>poupartia</i> Moq.
1 0 3 4 5	var. <i>requienia</i> Moq.	000(45)	var. <i>costasia</i> Moq.
0 2 3 4 5	var. <i>paladilhea</i> Locard.	0 0 0 : 5	var. <i>redia</i> Moq.
0 2 : 4 5	var. <i>mortilletia</i> Locard.	1 0 3 0 0	var. <i>perroudia</i> Locard.
0 0 3 4 5	var. <i>oliria</i> Moq.	0 0 3 0 0	var. <i>polia</i> Moq.

ENGLAND AND WALES.

Channel Isles—Var. *castanea*, Bordeaux harbour, Guernsey, rare; and sub-var. *petiveria*, Guernsey and Sark (Tomlin and Marquand, l.c.).

Cornwall W.—By signal station at Lizard Point, Aug. 1900, Rev. J. W. Horsley.

Cornwall E.—Saltash, Oct. 1909, C. E. Wright.

Devon S.—Common about Exeter, E. D. Marquand. Seaton, 1882, B. M. Oakeshott.

Devon N.—Ilfracombe, J. R. le B. Tomlin. Lynton, Aug. 1903, H. Beeston.

Somerset S.—Taunton, W. Gygell.

Somerset N.—Abundant in gorse on hillsides at Bratton St. Maur, sandhills at Burnham, and found in other places; sub-var. *petiveria*, Weston-super-Mare, on the higher slopes of Milton Cleveland, and on gorse at Bratton St. Maur, E. W. Swanton.

Wilts. N.—Marlborough, C. N. Bromehead; Devizes, C. D. Heginbotham; Edington, E. W. Swanton.

Dorset—Sub-var. *petiveria*, Chideock near Bridport, A. Belt.

Hants. N.—Preston Candover, Rev. H. P. Fitzgerald.

Sussex E.—Sub-vars. *petiveria* and *fulvo-tincta*, near Lewes, C. H. Morris.

Kent W.—Maidstone, H. Elgar and H. Lamb. Chislehurst, T. D. A. Cockerell.

Surrey—Prestwick, E. W. Swanton.

Essex S.—Chingford, June 1910 ! F. B. Jennings.

Essex N.—Colechester, J. Kidson Taylor.

Berks.—Maidenhead ! Lionel E. Adams.

Suffolk E.—Blaxhall, G. T. Rope.

Norfolk E.—Var. *castanea*, Unthinks road and Heigham, Norwich (Bellars, Br. Shells, 1858). Not frequent; sub-var. *cornea*, not unfrequent in the marshlands, as well as in the uplands. Alington, Surlingham, and Reedham, Rev. S. Spencer Pearce. Earlham, and plentiful at Horsham St. Faith's, A. Mayfield.

Cambridge—Whittlesey, H. J. Bellars.

Bedford—Welsh's lane and Bedford lane, Luton, 1887 ! J. Saunders.

Northampton—Widely dispersed, but never plentiful; a specimen found by Mr. Lionel E. Adams at Castle Ashby has the apical whorls yellow, *libellulo-castanea*.

Gloucester E.—Gloucester, A. G. Stubbs.

Gloucester W.—Quarry, Durdham Downs, May 1866 !

Hereford—Very common about Hereford, A. E. Boycott.

- Monmouth**—Piercefield, Chepstow, April 1909 ! F. H. Sikes.
Stafford—Ramsor Quarry, May 1898, and abundant in Dovedale, J. R. B. Masfield.
Beeston Tor, E. D. Bostock.
Glamorgan—St. Fagan's, F. W. Wotton. Penally, H. R. Wakefield.
Pembroke—Sub-var. *fulvo-tincta*, 00300, St. David's, J. Kidson Taylor.
Carnarvon—Abundant at Bettws-y-Coed, C. Ashford. Bangor, J. Ray Hardy.
Conway, July 1883 ! W. Denison Roebuck.
Merioneth—Barmouth, J. Kidson Taylor.
Denbigh—Llandudno, Thomas Glover.
Lincoln N.—Mablethorpe sandhills, common, one specimen with apical whorls bright yellow, *libellulo-castanea*, C. S. Carter. Habrough, Oct. 1908, and sub-var. *petiveria*, Bardney, Aug. 1906 ! J. F. Musham.
Derby—The Winnatts, Castleton, July 1901, and Deepdale, Buxton, J. Wilfrid Jackson. Mappleton, J. Davy Dean. Dovedale, Aug. 1892 ! F. Collier. Repton, J. Hagger. Matlock, J. A. Howe. Winster, Rev. H. Milnes.
Cheshire—Chester, Rev. H. Glanville Barnacle.
Lancashire S.—Between Naze and Freckleton, 1824, Thomas Glover. Simonstone, June 1889 ! R. Wigglesworth ; and Burnley, J. Russell Wildman.
Lancashire Mid—Goosnargh and Newsham near Preston, Robert Ständen.
Sub-var. petiveria, Lytham (Cockerell, Nat., 1888, p. 227).
York S.E.—Sub-var. *petiveria*, common at Wressle, G. Roberts.
York S.W.—Sandal and Barmby-on-the-Don, July 1886, George Roberts.
Apperley, 1889, F. Rhodes. Knottingley, John Emmet.
York Mid W.—Long Preston, J. Kidson Taylor.
Durham—Durham, J. Kidson Taylor.
Cheviotland—Alnmouth, on south side of the river Aln, Rev. Dr. McMurtrie.

SCOTLAND.

- Dumfries**—Grey Mare's Tail, 1886 ! J. Madison.
Selkirk—Holylee ! W. Denison Roebuck.
Haddington—North Berwick ! Rev. Dr. McMurtrie.
Fife—Links at Elie, Aug. 1886 ! T. Scott. North Queensferry ! W. D. Roebuck.
Forfar—Montrose ! W. Duncan.
Cantire—Tarbert ! T. Scott.

IRELAND.

- Monaghan**—Nobber ! P. H. Grierson.
Donegal—Plentiful, Bundoran, R. Welch. Portsalon, J. Kidson Taylor.
Fermanagh— Newtownbutler, J. G. Milne.
Louth—Ardee, P. H. Grierson.
Meath—Laytown, P. H. Grierson.
Dublin—Sandhills, Malahide ! J. E. Palmer.
Galway W.—Killeany, Aranmore, July 1895, R. Standen.
Clare—Var. *castanea*, Lahinch, 1907, P. H. Grierson ; and sub-var. *petiveria*, Ballyvaughan, Aug. 1894, E. Collier.
Tipperary S.—Sub-var. *petiveria*, Clonmel, Sept. 1904 ! Mrs. Malcolmson.

FOREIGN DISTRIBUTION.

- Germany**—Rufous or fuscous varieties recorded from East Prussia by Kleeburg. Sub-var. *petiveria*, Drachenfels, Nassau, Sept. 1882 ! Alfred Denny.
France—Var. *castanea* and sub-var. *cornea*, department of the Somme (Picard, l.c.) ; Lake of Silan, Ain (Locard) ; var. *castanea*, Saverdun, Ariège, and sub-var. *cornea*, Toulouse (Moquin-Tandon, l.c.) ; Mouy, Oise (Baudou) ; Arles, Bouches du Rhône, 1895 ! W. E. Clarke ; and Rouen, Seine Inférieure, Aug. 1885, S. C. Cockerell.
 Sub-var. *cornea* described from the department of the Somme by Picard ; and recorded from Toulouse, Haute Garonne (Moquin-Tandon, l.c.).
 Sub-var. *petiveria*, Bordeaux, Gironde, R. F. Scharff ; recorded from Lyons and the Ain by Locard ; from Haute Loire by Pascal ; and from Toulouse and Luchon, Haute Garonne, and Saverdun, Ariège ; with the banded sub-vars. 12345 from Puy-de-Dôme and Charente Inférieure ; 1:300 from Paris ; 00045 from Ariège ; 003(45), ::345 and :2345 from the Pyrénées ; and 00300, 000:5, 000(45), 00345, 00:45, 10345, ::::, (123)45, (113)(45), (12)345, and 1(23)45 from Toulouse by Moquin-Tandon.
Switzerland—Kanderthal, Canton Berne, J. R. le B. Tomlin.
Italy—Recorded from the province of Como by Porro.
Portugal—Var. *castanea*, somewhat rare, Coimbra, Aug. Nobre.
United States—Sub-var. *petiveria*, recorded from Lexington, Virginia, by Prof. J. L. Howe, in one octofasciate, two septemfasciate, and twelve different sexfasciate forms, in addition to many five, four, two and one-banded varieties.

Var. *olivacea* Risso.*Helicogena olivacea* Risso, Hist. Nat. Eur. Mérid., 1826, p. 63, no. 136.*Helix nemoralis* var. *gesneria* Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 167.*Helix nemoralis* var. *brunnea* Baudon, Moll. Oise, 1862, p. 20.*Helix nemoralis* var. *hepatica* Cockerell, Brit. Nat., April 1891, p. 65.*Helix nemoralis* var. *hepatica* Westerlund, Syn. Moll. Extrani., 1897, p. 57.

The *H. olivacea* Risso is referred to *H. nemoralis* by Mortillet, but Bourguignat allocates it with *Helix sylvatica*.

The var. *olivacea* has the shell of a deep olive brown, frequently showing a violet shade inside, and externally a distinct yellow rim adjoining the peristome.

The sub-var. *gesneria* is described as olivaceous.

The sub-var. *brunnea* is regarded by its author as described by its name.

The sub-var. *hepatica* Cockerell is "liver colour, suture and part of spire whitish. Near to f. *castanea*."

The horehound (*Ballota nigra*) produces very dark brown or nearly black shells, according to Mr. J. Hawkins, of York.

As subsidiary forms of the var. *olivacea* the following band variations have been recorded and named:—

1 2 3 4 5 var. *schafferia* Moq. 0 0 3 4 5 var. *voigtia* Moq.

and the following as possessing a brown ground colour are probably referable to Baudon's sub-var. *brunnea*:—

1 2 3 4 5 var. *kreglingeria* Locard. 0 0 3 0 0 var. *enthymea* Locard.

ENGLAND AND WALES.

Channel Isles—Very rare, Moulin Huet, Guernsey (Tomlin and Marquand, l.c.).
Island of Sark, July 1905, F. H. Sikes.

Cornwall W.—Housel Bay, Sept. 1910 ! A. H. Pawson.

Cornwall E.—Saltash, 02300, Oct. 1909, C. E. Wright.

Devon S.—Exeter, July 1904, C. E. Wright.

Somerset S.—Taunton, Rev. E. W. W. Bowell.

Somerset N.—Boltonsborough, Aug. 1895 ! S. C. Clapham. Milton Cleveland, near Bruton and Burnham, E. W. Swanton.

Wilts. N.—Devizes, C. D. Heginbotham; Gt. Bedwyn (Townsend), E. W. Swanton.

Dorset—Bridport, Aug. 1900, C. E. Wright.

Hants. S.—Rowlands Castle, 1909; a large colony, Cosham, 1903, C. E. Wright.

Sussex E.—Sub-var. *hepatica*, Lewes, C. H. Morris (T. D. A. Cockerell, l.c.).

Kent E.—Minster and Walmer, Sept. 1900, C. E. Wright.

Surrey—Grayswood and Prestwick, E. W. Swanton.

Essex S.—Chingford, June 1910 ! F. B. Jennings.

Essex N.—Chignal St. James, R. Miller Christy.

Bucks.—Colnbrook, June 1906 ! F. H. Sikes.

Suffolk E.—Gorleston, July 1899, C. E. Wright.

Norfolk E.—Rare, Alington, Rev. S. S. Pearce. Horsham St. Faith's, A. Mayfield.

Norfolk W.—Mildenhall, A. Mayfield.

Cambridge—Fen Ditton, May 1907; and Chesterton, Oct. 1909, C. E. Wright.

Northampton—Woolastone, Sept. 1895; Oundle, Sept. 1905, etc., C. E. Wright.

Gloucester W.—Durdham Downs, Bristol, May 1866 ! W. Nelson.

Stafford—Acton and canal bank, Rugeley, Oct. 1898, C. E. Wright. Common in hedges about Stafford in 1884 and 1885, Lionel E. Adams.

Cardigan—The prevailing form at Aberystwyth, May 1888, E. Collier.

Denbigh—Great Orme's Head, 00300 and 00345, Aug. 1906, C. E. Wright.

Lincoln N.—Mablethorpe, June 1907, and Bardney, Sept. 1908, J. F. Musham.

Leicester—Canal side, Leicester, March 1898, C. E. Wright.

Derby—Matlock, J. A. Howe. Castleton, J. Kidson Taylor.

Lancashire S.—Preston, Southport, and Formby (Dyson, Shells of Manchester, 1850, p. 30). Farington, J. Kidson Taylor.

Lancashire Mid—Lytham (D. Dyson, op. cit.).

York S.E.—Hedon, Tom Petch.

York N.E.—Scalby and Robin Hood's Bay ! Prof. A. Harker.

York Mid W.—Long Preston, J. Kidson Taylor.

IRELAND.

Donegal—Gola Island, Sept. 1908, C. E. Wright.

Louth—Mellifont Abbey and Ardee ! P. H. Grierson.

Meath—Julianstown, April 1909 ! R. F. Scharff. Laytown, P. H. Grierson.

Dublin—Glen Druid near Carrickmines, Oct. 1886 ! W. F. de Visnes Kane.

Tipperary S.—Near Clonmel, Rev. A. H. Delap.

FOREIGN DISTRIBUTION.

Germany—Sub-var. *brunnea*, recorded for North Germany by A. Schmidt; and for the Rhine Valley below Bonn by Prof. Beddard.

France—Reported from Salies-de-Bearn, Basses Pyrénées, by Hugh Watson. Sub-var. *gesneria*, Saverdun, Ariège, and the banded sub-vars. 12345, 1:345, and 00345 from Toulouse, Haute Garonne (Moquin-Tandon, l.c.).

Sub-var. *brunnea*, Mony, Oise (Bandon, l.c.).

Holland—Heerenveen, Friesland, Aug. 1909! F. H. Sikes.

Spain—Castelcarrera, Old Castile! Prof. J. G. Hidalgo.

Portugal—An uniformly brown variety reported from Alemtejo by Morelet.

United States—Var. *olivacea* 00000 and 00300, and sub-var. *hepatica* 00000, recorded from Lexington, Virginia, by Prof. J. L. Howe.

VARIATIONS IN BANDING OF SHELL.

This section takes cognizance of the character and direction of the bands, their varying number and differing arrangements, as well as their degrees of development, but not of their lack of pigmentation and varied colouring.

Var. *fasciata* Moquin-Tandon.

Helix cincta and *quinguefasciata* Sheppard, Linn. Trans., 1825, xiv., p. 163.

Helicogena imperfecta Risso, Hist. Nat. Eur. Merid., 1826, p. 62.

Helix nemoralis vars. *unifasciata*, *bifasciata*, *fusca bifasciata*, *trifasciata*, *inequalis*, *quatuor fasciata*, *bigeminata*, *nigra* and *sexfasciata* Picard, Moll. Somme, 1840, p. 184-5.

Helix nemoralis var. *intermedia* Rossm., Icon., 1842, ii., pt. 2, pl. 51, p. 685.

Helix nemoralis vars. *fasciata*, *coalita*, *interrupta*, *punctella*, and *septemfasciata* Moquin-Tandon, Hist. Moll., 1855, ii., pp. 162 and 167.

Helix nemoralis var. *pseudoaustriaca* Clessin, Deutsch. Moll., 1884, p. 207.

Helix nemoralis var. *mista* Boycott and Bowell, Sci. Goss., 1897, p. 132.

SHELL with dark spiral banding, which may be continuous or more or less interrupted and is frequently coalescent; it includes all spirally banded forms, whether the fasciation be continuous or interrupted, isolated or coalesced.

The var. *fasciata* Moq., *sensu stricto*, is especially applied to shells with distinct and definite spiral bands with little or no tendency to coalescence, and other than five in number; the five-banded form being distinguished as var. *quinguefasciata*. The *Helix quinguefasciata* Sheppard also refers to the five-banded variety only, which was regarded by him as a distinct species.

The sub-var. *imperfecta* (*Helicogena imperfecta* Risso) described as characterized by faint and broken basal banding.

The sub-var. *interrupta* Moq., has the continuity of the bands interrupted.

The sub-var. *punctella* Moq., has the bands broken up into spots.

The sub-var. *coalita* Moq., embraces all shells upon which two or more bands are coalesced to form one or more groups. The forms *nigra* Picard, *nigrescens* Grateloup, and probably *latefasciata* Rolle, are shells in which all the five bands are present and unite to form one excessively broad band, as shown by the formula (12345).

The sub-var. *quatuor fasciata* Picard displays four simple or composite bands, and may be represented by the formulæ (12)345, 12340, etc.

The sub-var. *bigeminata* Picard is the most striking tetrafasciate form, displaying two narrow bands above the periphery, separated by a wide interval from the two broader bands at the base; its formula is 12045.

The sub-var. *trifasciata* Picard has three simple or compound bands, and is equally correctly represented by the formulæ 12300, (12)3(45), etc.

The sub-var. *inequalis* Picard is a subsidiary form, with two narrow bands above the periphery, and one very broad one below, or inversely; it may be represented by the formulæ 120(45), (123)45, etc.

The sub-var. *bifasciata* Picard includes all the two-banded shells whether the bifasciation be due to the presence of two simple bands or to two separate groups, each made up by the fusion of two or more bands, and can be equally correctly represented by 12000, (123)(45), etc.; if, however, owing to fusion, the bands are so broad that the two groups are almost united, it is var. *fusca-bifasciata* Picard.

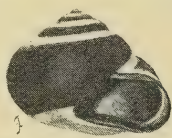


FIG. 366.—*Helix nemoralis* var. *coalita* Moq. (Truro, Cornwall).

The sub-var. **cineta** (*Helix cineta* Sheppard) refers strictly to the one-banded form 00300, which was regarded as a separate species. The sub-var. **unifasciata** Picard is described as possessing a single band only, either simple or compound, and may be expressed by the formulæ 00300, 0(23)00, etc.

The vars. **sexfasciata** Picard, **septemfasciata** Moquin-Tandon, **octofasciata**, **novemfasciata**, **decemfasciata** and **duodecemfasciata** have six, seven, eight or more bands respectively; these supplementary bands are, however, not real additions to the normal number, but due to dismemberment of one or more of the regular bands consequent on a disruption of the pigment cellules on the mantle margin of the animal, and this disintegration almost invariably takes place with the peripheral bands, and only rarely from the splitting of the outer ones.

The sub-var. **mista** is described as typically a heavily and dark-banded shell upon a pale ground tint, which is neither bright in colour nor definite in shade, but which in the opinion of its authors should be classified with var. *rubella*.

The sub-var. **intermedia** is described as having a rounder aperture, and as being of a pale straw-yellow colour, with formula 10345, the last more closely encircling the umbilicus as in *H. austriaca*, and thus linking the two species.

The sub-var. **pseudoaustriaca** is described as strong-shelled, and as showing relationship with *H. austriaca* in the basal banding encircling the umbilicus more closely than in typical *H. nemoralis*; the similarity is still further shown by the wide and coalescent basal banding.

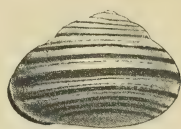


FIG. 367.—A duodecemfasciata shell of *Helix nemoralis*.

ENGLAND AND WALES.

Hereford—Sub-var. *mista*, common (Boycott and Bowell, l.c.). They also report sexfasciate specimens of var. *libellula* with formulæ 123345, 123×45, 123×(45), and (123)×(45); of var. *rubella* one specimen with formula (12)3×45 is reported; and of sub-var. *mista* 123×45, 123×45, (12)×345, 1(23)×45, (12)3×45, (123)×(45), [1(23)×45], [(12)×345], and [123345], while several other theoretically sexfasciate specimens are detailed in which the duplication of bands coexists with the suppression of one or more of the normal five.

Lincoln—Mr. J. F. Musham reports sexfasciate specimens of the var. *libellula* from this county, amongst them 123×(45), and 123×(45), in addition to several specimens with duplicated bands, in which one or more of the normal five are suppressed. Of the sub-var. *carnea* he possesses the novemfasciate form, which he reports as 123345678, and of *sexfasciata* 1233 (45), and 1234(45), besides several with split bands, but deficient of one or more of the normal five.

York S.E.—Sub-v. *sexfasciata* 123×45, Settrington lane, Norton, B. B. Woodward.

FOREIGN DISTRIBUTION.

Germany—Sub-var. *pseudoaustriaca*, Thuringia (Clessin, l.c.).

Sub-var. *sexfasciata*, cited from Chemnitz, Saxony.

France—Sub-var. *sexfasciata*, recorded from Toulouse, Haute Garonne, by Moquin-Tandon; by Pascal as less rare in Haute Loire than about Paris; from the Somme by Picard; and by Grateloup from Paris, and Moissac, Tarn-et-Garonne.

Sub-var. *septemfasciata*, a single example from north of France (Moq.-Tand., l.c.).

Sub-var. *nigrescens*, cited by Dr. Grateloup from the Landes at Dax.

Sub-var. *imperfecta*, cited for Alpes Maritimes by Risso.

Sub-var. *interrupta*, for Haute Loire and environs of Paris by Pascal.

Austro-Hungary—Sub-var. *interrupta*, Stussiner, cited from Laibach, Carniola.

Sub-var. *intermedia*, Brenner Pass, Tyrol (Rossm., l.c.).

Portugal—Sub-var. *quinquefasciata*, a common form at Coimbra, A. Nobre.

Switzerland—Sub-var. *sexfasciata* recorded by Charpentier, at Dévens, Vaud.

Sub-var. *imperfecta* recorded by Sandberger from the Swiss Jura, and several localities about Laufenburg, near Geneva.

United States—Some hundreds of supplementary band variations have been recorded from Lexington, Virginia, U.S.A., by Prof. Cockerell, Prof. Howe, etc., the most remarkable being the duodecemfasciate variety [1223344555] which shows seven additional bands; other noticeable but commoner forms are the decemfasciate, the novemfasciate, the octofasciate, the septemfasciate, and the sexfasciate shells, of which the following formulæ are respectively representative: ((12)×33)×(4(55)), (12)3(33)3(45), 123×4(×5), (12)(33)×(45), and ×12345.

In Pennsylvania a number of half-grown bandless specimens were liberated at Blairsville, and have prospered there; the locality, however, now yields a preponderance of banded shells.

Var. *undulata* Gentil.

Helix nemoralis var. *undulata* Gentiluomo, Bull. Mal. Ital., 1867, i., p. 9, pl. 1, ff. 9, 10.
Helix nemoralis var. *erjavecii* Kobelt, Rossm. Icon., p. 37, f. 1966.

SHELL with the spiral banding broken-up, and fused transversely at intervals, forming oblique dark streaks across the whorls.

It is also the var. *transversa* Wilcock MS., Cockll.

The sub-var. *erjavecii* is described as usually showing the formula 0(23)(45), with a series of slender but irregularly spotted darker transverse lines, restricted to the zonal region.

The sub-var. *erjavecii* is a modification of the var. *undulata*, differing chiefly from characteristic specimens of that variety in the pale chestnut coalescent spiral banding being perceptible beneath the numerous slender, dark, and somewhat blotchy transverse lines, which are coincident with the lines of growth, and extend over the area normally occupied by the zonation.

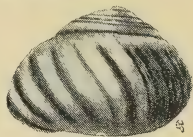


FIG. 368.—*Helix nemoralis* var. *undulata* Gentil. (Blagdon, Bristol).

ENGLAND AND WALES.

- Devon N.—Barnstaple, H. Beeston and C. E. Wright.
 Somerset N.—Hedgebank on summit of Milton Clevedon hill; also at Grovelands, Bratton St. Maur, E. W. Swanton.
 Hants S.—Fordingbridge, 1886! Hugh Richardson.
 Hants. N.—Alresford! Rev. W. L. W. Eyre.
 Northampton — Railway embankment, Great Houghton, Lionel E. Adams. Catesby, Oct. 1899, C. E. Wright.
 Gloucester E.—Cotswold Hills, J. R. B. Masefield.
 Monmouth — Piercefield Woods, Chepstow! F. H. Sikes.
 Warwick — Nuneaton, C. E. Wright.
 Stafford — Garden, Cheadle, J. R. B. Masefield.
 Lincoln S.—Canwick, July 1907, J. F. Musham.
 Lincoln N.—Bardney, Sept. 1907, J. F. Musham.
 Lancashire S.—Southport! W. H. Heathcote.
 Lancashire Mid—Canal side, Bolton-le-Sands, Aug. 1905, H. Beeston. Morecambe, J. Davy Dean.
 York S.E.—Spurn, T. Petch. Bridlington, Sept. 1902, C. E. Wright.
 York N.E.—Castle Hill, Scarborough, J. A. Hargreaves.
 Westmorland and Lake Lancashire.—Hampsfell and Kirkhead, H. Beeston.
 Cumberland—Common about Bassenthwaite and Keswick, W. J. Farrer.

IRELAND.

- Dublin—Dollymount, June 1883! J. R. Redding.
 Roscommon—Ballymore, Sept. 1889! J. G. Milne.
 Galway W.—Loughrea, Dr. R. F. Scharff.
 Kerry—Rectory garden, Valentia, Miss Delap (Carrington, Sc. Goss., 1899, p. 229).

CONTINENTAL DISTRIBUTION.

- Italy—Lucca (Gentiluomo, l.c.).
 Austro-Hungary—Sub-var. *erjavecii*, Gorz, Styria (Kobelt, l.c.).
 Portugal—Morelet records from the neighbourhood of Oporto specimens in which the bands are interrupted by prominent striae of the same colour.

VARIATIONS IN COLOUR OF BANDING.

Var. *fascialba* Picard.

Helix nemoralis var. *fascialba* Picard, Moll. Somme, 1840, p. 184.
Helix nemoralis var. *leucozona* Taylor, MS.

SHELL with a pale, more or less calcified and opaque peripheral band, usually on a darker but more translucent ground tint, which represents a former scheme of banding now lost by suffusion and degeneration, and upon which the more modern bands are developed, the pale peripheral band really indicating the original or a more primitive ground colour.

This variety is one of the most interesting and suggestive of the whole range this species offers, and has been hitherto named and distributed as var. *leucozona*, but Picard's name takes precedence; it is evidently an atavistic form and must be classified with the similar palaeogenic forms exhibited by *Helix cantiana*, *H. hispida*, *H. rufescens*, and other species. This former scheme of colouring may be readily recognized even when complicated with the presence of the more modern

scheme of fasciation, as the space between the upper and lower group of bands of the ancient band arrangement is not coincident with that separating the modern banding, but invariably occupies a higher position on the whorl, so that the modern dark peripheral or third band is developed almost in the centre of the formerly existent peripheral space, which is thus really supra-peripheral and clearly indicates a former approximation in band arrangement to that which now characterizes the somewhat more primitive yet subdominant South-European genus *Campylaea*.

In North Wales Mr. W. Denison Roebuck remarks on the relative abundance of specimens displaying a prominence of the pale central band; and Mr. Carrington has also noted it as frequently present in the south of England examples.

ENGLAND AND WALES.

Channel Isles—Var. *rubella*, 00300, Guernsey (Tomlin and Marquand, J. of C., 1903, p. 288). Vars. *libellula* and *rubella*, Sark, Aug. 1910 ! Miss Westernman.

Devon S.—One on a hedge near Exeter, with pale orange-coloured ground, E. Parfitt, Trans. Devon. Assoc., 1874, p. 635. Sidmouth, April 1898, Guy Breeden.

Devon N.—Var. *rubella*, Ilfracombe and Lynton, Aug. 1903, H. Beeston.

Somerset N.—Var. *castanea* 00300, Bitton near Bath, 1877 ! Miss F. M. Hele. Rimpton, June 1906 ! E. W. Swanton.

Sussex E.—Var. *rubella* 00300, Lewes, Oct. 1896, C. H. Morris.

Kent W.—Chislehurst ! T. D. A. Cockerell.

Essex S.—Sub-var. *rubra* 00300, Chingford, June 1910 ! F. B. Jennings.

Middlesex—Sub-var. *carnea* 00300, Ponder's End, May 1910 ! F. B. Jennings.

Oxford—Eynsham, A. H. Jowett Murray.

Suffolk E.—Vars. *libellula* and *rubella*, Gorleston, July 1899, C. E. Wright.

Norfolk W.—A colony at Hunstanton with peripheral band split and imposed upon the median area, Lionel E. Adams.

Hunts.—Var. *rubella*, Little Paxton, June 1907, C. E. Wright.

Northampton—Var. *castanea* 00305, with white peripheral space, Denford, July 1900, C. H. Morris. Railway bank, Barford; var. *rubella*, with white peripheral space, Isham, June 1895; Maidwell Vale, 00300, Oct. 1905; Catesby, 00300, Sept. 1898, C. E. Wright.

Gloucester E.—Common about Gloucester, formulae 00000 and 00300, A. G. Stubbs.

Stafford—One at Stafford, with red ground colour, May 1895, L. E. Adams.

Brecon—Var. *rubella*, with yellowish atavie zone, found by J. Williams Vaughan.

Radnor—One found by J. Williams Vaughan.

Cardigan—Sandhills, Borth, A. H. Jowett-Murray.

Carnarvon—Var. *libellula* 00345, Pwllheli, Aug. 1910 ! F. H. Sikes.

Denbigh—Fairly common about Llandudno, July 1877 ! W. Denison Roebuck.

Leicester—Leicester, T. Edwards. Narborough, July 1885 ! H. E. Quilter.

Derby—Sub-var. *carnea* 00300, Winster ! Rev. H. Milnes.

Lancashire Mid—Specimens labelled 'Blackpool' in Blackpool Public Museum.

York S.E.—Sewerby near Bridlington, May 1905, W. E. Brady.

York S.W.—Upton near Pontefract, Aug. 1903, and somewhat frequent in the vars. *rubella* and *libellula* at Barugh near Barnsley, June 1905 ! W. E. Brady.

Cheviotland—Bamburgh, Dr. J. McMurtrie.

Isle of Man—Var. *rubella* 00300, Colby Glen, Sept. 1887 ! J. E. Mason.

SCOTLAND.

Edinburgh—Capt. Brown found a specimen with rose coloured lip at West Coates, Edinburgh (British Shells, 1845, p. 57).

IRELAND.

Down—Sand dunes, Killard Point, Portaferry, Mrs. Russell.

Galway W.—A yellow albolabiate shell, 00300, Roundstone ! C. E. Wright.

Clare—In wet moss on shales, Ennistimon, 1907 ! P. H. Grierson.

Tipperary S.—Near Clonmel ! Rev. A. H. Delap.

Kerry—In the Kerry specimens, according to Mr. J. T. Carrington, the white peripheral zone is somewhat frequently present.

CONTINENTAL DISTRIBUTION.

France—Described by M. Picard from specimens found in the department of the Somme; found by Dr. Scharff at Bordeaux, Gironde; and by Mr. F. H. Sikes at Painspol, Côtes du Nord.

Switzerland—Var. *citrinizonata*, 00300, with whitish peripheral zone, Canton Ticino, collected by Herr Scheuchzer.

Spain—Andorra, 00345, May 1889 ! W. Eagle Clarke.

Sweden—Recorded by Malm from Calmar with formula 00340, and 00300 with a whitish zone beneath the peripheral band.

Var. **rufozonata** Cockerell.*Helix nemoralis* var. *rufozonata* Cockerell, Sci. Goss., 1887, p. 67.SHELL "with red-brown bands, and having the pale-lipped character of *v. hybrida*."The author of the variety remarks on the simultaneous occurrence at Torquay of this rufozonate form in *H. nemoralis* and *H. hortensis* in company with the exactly corresponding form—*lutescens*—in *H. aspersa*.The var. **citrinozonata** Cockerell (Sci. Goss., Aug. 1887, p. 77) "bands pale-brown" would, if correctly described, be placed here.

ENGLAND.

Devon S.—Torquay, 1886, F. W. Wotton.

Gloucester E.—Stroud ! W. Gygell.

Lincoln N.—Grisel Bottom, Louth, Sept. 1889 ! W. Denison Roebuck.

Notts.—Attenborough Bogs, June 1878 ! C. T. Musson.

York N.E.—Cayton Bay ! W. Gygell. Kirkleatham, Sept. 1886 ! W. D. Roebuck.

York S.W.—Kexborough near Barnsley (123)(45), Aug. 1906 ! W. E. Brady.

SCOTLAND.

Berwick—Berwick, Aug. 1889 ! W. A. Gain.

Dumbarton—High Mains, Aug. 1886 ! W. Denison Roebuck.

Cantire—Tarbert, June 1886 ! T. Scott.

IRELAND.

Leitrim—Glencar, July 1809 ! P. H. Grierson.

Tipperary N.—Carrigahorig, R. A. Phillips.

Kerry—Killarney, July 1907 ! W. Denison Roebuck.

Var. **lateritia** Dumont and Mortillet.*Helix nemoralis* var. *lateritia* Dumont and Mortillet, Moll. Savoie, 1857, p. 84.*Helix nemoralis* var. *vinosofasciata* Taylor and Roebuck, Pr. Roy. Ir. Ac., 1886, p. 681.*Helix nemoralis* var. *roseozonata* Cockerell, Sci. Goss., 1887, p. 177.

SHELL of a pale opaque brick-red colour, with translucent reddish bands and rose coloured peristome.

The sub-var. **roseozonata** has pink banding.The sub-var. **vinosofasciata** has the bands of a vinous tint, but was not formally described, the name being descriptive.Dumont and Mortillet suggest that this variety is probably a hybrid between the variety *carnea* and the variety *albinos* of Charpentier.

ENGLAND AND WALES.

Devon S.—Sub-var. *roseozonata*, rare and local, Topsham, Aug. 1892, L. E. Adams.Devon N.—Sub-var. *roseozonata*, Ilfracombe and Mortehoe, H. Beeston.Somerset N.—Cheddar, F. H. Sikes. Sub-var. *roseozonata* 12345 and 023(45), Blagdon ! Miss Hele.Hants. S.—Sub-var. *roseozonata*, on sandbank, Hayling, Jan. 1896, C. E. Wright.Sussex E.—Sub-var. *vinosofasciata*, Lewes ! J. H. A. Jenner.Kent W.—Sub-var. *roseozonata*, Bickley (T. D. A. Cockerell, l.c.).Essex—Sub-var. *roseozonata*, Cotteshall, C. E. Wright.Middlesex—Sub-var. *roseozonata*, Acton Green (T. D. A. Cockerell, l.c.).Northampton—Sub-var. *roseozonata*, Blisworth, June 1906, Rev. W. A. Shaw.

Golf links and railway bank, Kettering, June 1893 and Aug. 1896, C. E. Wright.

Stafford—Sub-var. *roseozonata*, Stoke-on-Trent ! W. Gygell.Pembroke—Sub-var. *roseozonata*, Manorbier near Tenby, A. G. Stubbs.Denbigh—Morfa, Llandudno, J. R. le B. Tomlin ; and sub-var. *vinosofasciata*, July 1883 ! W. Denison Roebuck.

Cheshire—Chester, Rev. H. Glanville Barnacle.

York S.E.—Sub-v. *roseozonata*, Cottingham, J. W. Boulton ; Ridgmont, T. Petch.York N.E.—Sub-var. *roseozonata*, Castle Hill, Scarborough, J. A. Hargreaves.York S.W.—Sub-var. *roseozonata*, Knottingley ! J. Cordukes ; Kexborough, June 1906, and Kirk Smeaton, May 1908 ! W. E. Brady.York Mid W.—Sub-var. *roseozonata*, near Keighley, Fred Taylor.

SCOTLAND.

Renfrew—Sub-var. *roseozonata*, Greenock, June 1888 ! A. Scott.Cantire—Sub-var. *vinosofasciata*, Tarbert, June 1886 ! T. Scott.

IRELAND.

Donegal—Sub-var. *roseozonata*, Bundoran, and Carrickfin, Sept. 1908, E. Collier.Dublin—Sub-var. *vinosofasciata*, near Dublin ! J. R. Redding.Sligo—Sub-var. *roseozonata*, Sligo, E. Collier.Galway W.—Sub-var. *roseozonata*, Gentian Hill, Galway ; and Killeany, Aranmore, July 1895 ! E. Collier.

CONTINENTAL DISTRIBUTION.

France—Trouville, Calvados, Sept. 1907, F. H. Sikes; and cited as common at Chateau des Tours, Bonneville, Upper Savoy, by Dumont and Mortillet.

Switzerland—Sub-var. *roseozonata* 03000 collected in Canton Ticino by Herr Scheuchzer.

Var. *citrinozonata* Cockerell.

Helix nemoralis var. *albinos* Charpentier, Moll. Suisse, 1837, p. 7.

Helix nemoralis var. *citrinozonata* Cockerell, Nat. World, March 1887, p. 43.

The var. *citrinozonata* of Cockerell was first described in March 1887 as possessing pale yellow bands, but the following August the author, probably by error, described the bands as "pale brown." The var. *citrinozonata* of Swanton is not this variety, being described, probably from oversight, as possessing dark-green banding.

The sub-var. *albinos* Charp. has a clear yellowish ground colour with transparent yellowish bands and white aperture.

ENGLAND AND WALES.

Cornwall W.—Truro, J. H. James.

Devon N.—Croyde Bay, E. Collier.

Somerset N.—Sub-var. *aurantia*, with paler yellow bands and peach-coloured lip at Wells (Rev. A. M. Norman, Moll. Somerset, 1860, p. 142). Abbott's Hill, Bratton St. Maur, E. W. Swanton. Westbury-on-Trim, Oct. 1909, C. E. Wright.

Sussex W.—Worthing, B. M. Oakeshott (Cockerell, op. cit.).

Sussex E.—Lewes, Jan. 1897, C. E. Wright.

Kent E.—Deal, sandhills, Rev. J. W. Horsley. Folkestone, very rare, Mrs. Fitzgerald. Walmer and St. Margaret's, Sept. 1900, C. E. Wright.

Berks.—Maidenhead, 12345, Lionel E. Adams.

Suffolk E.—Gorleston, July 1899, C. E. Wright.

Northampton—Glen, Nov. 1899; railway bank, Barford, Aug. 1896; Kettering, April 1896; and Catesby, Sept. 1898, C. E. Wright.

Pembroke—Manorbier near Tenby, A. G. Stubbs.

Leicester—Great Easton, in garden, Sept. 1898, C. E. Wright.

Derby—Winnatt's Pass, Castleton, May 1906, R. Cairns.

York S.E.—Bridlington, June 1886! W. Denison Roebuck.

York N.E.—Castle Hill, Scarborough, J. A. Hargreaves. Old chalk-pit on the wolds near Scarborough, W. Gynge.

York S.W.—Barugh near Barnsley 123(45), April 1905! W. E. Brady.

SCOTLAND.

Stirling—Bardowie Loch, Alex. Shaw.

IRELAND.

Donegal—Plentiful locally near Bunbeg and Carrickfin, 1909, R. Welch. Cruit Island, Sept. 1908, C. E. Wright.

Sligo—Sligo, E. Collier. Specimens labelled "Cliffony" in Blackpool Museum.

CONTINENTAL DISTRIBUTION.

Germany—Recorded for North Germany by A. Schmidt.

Belgium—Not uncommon at Lessines, Hainault, Oct. 1868, J. Colbeau.

Switzerland—Canton Ticino, with violet aperture and formulæ 12345 and 12+345, collected by Herr Scheuchzer. Sub-var. *albinos* recorded by Charpentier from vineyard walls, Georgette, near Lausanne, Vaud.

Var. *olivaceozonata* Collier, Journ. of Conch., July 1909, p. 292.

SHELL with "distinctly olive-coloured bands, darkest near the mouth, which is of the same colour."

IRELAND.

Derry—Magilligan Strand, with formulæ 12345, (12345), (123)(45), 1(23)45, 10345, etc., Sept. 1908! Dr. G. W. Chaster.

Var. *hyalozonata* Taylor.

Helix nemoralis var. *pudivosa* Stabile, Prosp. Moll. Lugano, 1859, p. 26.

Helix nemoralis var. *pallida* LeComte, Bull. Soc. Mal. Belg., 1872, p. xxvi.

Helix nemoralis var. *hyalozonata* Taylor, Journ. of Conch., 1883, p. 34.

The var. *hyalozonata* Taylor has the bands colourless and transparent. The shell of this variety when containing the living animal appears of a greenish tint, from the body of the animal showing through the pale yellow semi-transparent substance of the shell.

The sub-var. **pallida** Lecomte is described as yellow with transparent bands and yellowish-white peristome.

The sub-var. **pudiosa** Stabile has transparent bands, but it is not perfectly certain that the variety pertains to *H. nemoralis*.

In the sub-vars. **lurida** of Moq. and **fascia pallescens** of Picard the bands are irregularly indistinct or translucent and constitute intermediate forms connecting the typically hyalozonate shell and those with bands normally pigmented.

The variety, according to the observations of Mr. E. Collier, has very deciduous epidermis, the shell soon becoming weathered, and the light cream coloured epidermis coming away in flakes, leaving the shell of a pure white with transparent bands.

Mr. Hawkins records that the favourite food plant of this variety appears to be *Pastinaca sativa*, while Mrs. Fitzgerald always found them high up on ash trees.

As modifications of the var. *hyalozonata* with a yellow ground colour and transparent or indistinct bands, are the var. *lutea fasciis hyalinis* of Pirona and the undermentioned band variations named by continental authorities:—

1 2 3 4 5	var. <i>hermannia</i> Moq.	0 (2 3) 0 0	var. <i>detangena</i> Locard.
: 0 3 4 5	var. <i>magninia</i> Locard.	0 0 3 0 0	var. <i>duchampia</i> Locard.

The var. *favrea* Moq. 00045 has a pale yellow ground, var. *foucheyrandia* Locard 00345 a white one, that of the var. *leachia* Moq. 12345, is of a rosy-red, as are the vars. *rosea fasciis hyalinis*, and *leucostoma rosea fasciis hyalinis* 00300 of Pirona.

Upon a brown ground the following formulæ are distinguished:—

1 2 3 4 5	var. <i>sturmia</i> Moq.	0 0 3 4 0	var. <i>lathania</i> Moq.
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ENGLAND AND WALES.

Cornwall W.—Near Porthleven; Aug. 1900, Rev. J. W. Horsley. Newquay, Sept. 1884 ! and Truro, July 1885 ! J. H. James.

Devon S.—Sidmouth, April 1898, Guy Breeden.

Somerset N.—Burnham, rare, E. W. Swanton.

Hants. S.—Hayling, Oct. 1898, C. E. Wright.

Sussex E.—Lewes, local, J. H. A. Jenner.

Kent E.—Folkestone, Mrs. Fitzgerald.

Kent W.—Shepherdswell, July 1898, C. E. Wright.

Surrey—Haslemere, C. Pannell, jr.

Middlesex—Islington, 1851 ! J. Ray Hardy.

Norfolk E.—A roseolabiate specimen at Earlham, A. Mayfield.

Northampton—Peterborough and Eye, Sept. 1882 ! T. W. Bell. Tywell, July 1896, C. E. Wright.

Gloucester E.—Amongst a luxuriant growth of blackberries near Gloucester, Oct. 1879 ! Rev. H. Milnes.

Stafford—Harborne, Guy Breeden.

Denbigh—Near Llandudno, on sides of road leading to Conway, 1853, Thomas Glover. Morfa, Llandudno, J. R. le B. Tomlin.

Lincoln N.—North Ormsby, 1900, C. S. Carter. Lime quarries, Lincoln, July 1898, C. E. Wright.

Notts.—Ditch side near Tuxford, W. A. Gain.

Derby—Matlock, J. A. Howe.

Cheshire—Chester, April 1884, Rev. H. G. Barnacle.

Lancashire Mid—Blackpool, F. Collier.

York S.E.—Burstwick near Hull ! F. W. Fierke. Bridlington, Rev. W. C. Hey ; Ridgmont, Hedon, and Flamborough, T. Petch.

York N.E.—Castle Hill, Scarborough, J. A. Hargreaves ; and old chalk-pit, Willerby Wold near Scarborough, W. Gygell.

York Mid W.—Near Bingley, J. Beanland. Hobmoor near York, R. M. Christy.

Cheviotland—Nigro-labiate shells on sandhills, Alnmouth, Rev. Dr. McMurtrie.

Isle of Man—Douglas road, Peel, Aug. 1891, R. Cairns.

IRELAND.

Antrim—Island Magee, R. Welch.

Down—Falls road, Belfast, 1892, R. Welch.

Donegal—Fenner Strand, Bundoran sandhills, a heavy form, a few of the most aged averaging 37 grains in weight, R. Welch.

Galway W.—Killeany, Aranmore, July 1895, E. Collier.

Clare—Ballyvaughan, Aug. 1894, E. Collier.

CONTINENTAL DISTRIBUTION.

Germany—Recorded for North Germany by A. Schmidt; as rare about Frankfurt, Nassau, by Dr. Kobelt; and sub-var. *pallida* is cited for Germany by LeComte.

France—Recorded from Valenciennes, Nord, by Norguet; from Chateau des Tours, St. Etienne, and Marignier, near Bonneville, Upper Savoy, by Dumont and Mortillet; from near Lyons by Locard; the sub-vars. *leachia* and *hermannia* of Moquin-Tandon from Auxonne, Côte d'Or, by Wattebled; also recorded as common at Montvendre, Drôme, by Sayn; and from the Grande Chartreuse, Isère, by Rev. S. Spencer Pearce.

Belgium—Recorded from the dunes, Nieuport, West Flanders, by Staes; and by Timmermans for Brussels, Brabant.

Sub-var. *pallida* is common among nettles and bushes at Lessines, Hainault; and more rarely found at Louvain, Charleroi, Wavre, etc., in Brabant (LeComte, l.c.).

Italy—Recorded for Camaiore, Tuscany, by Dr. del Prete. Sub-vars. *lutea fasciis hyalinis*, and *rosea fasciis hyalinis* are cited from Udine, and *leucostoma rosea hyalina* 00300 from Monajo, Venetia, by Prof. Pirona. Sub-var. *putidiosa* is recorded for Val d'Esino, Lombardy, by Pini; and was found at Lemno and Menaggio with formule 12345, 12340, 12300 and 00300, by J. R. le B. Tomlin.

Austro-Hungary—Sub-var. *pallida*, Hungary and Dalmatia (M. LeComte, op. cit.).

Spain—Republic of Andorra, May 1889! W. E. Clarke. Through the courtesy of Prof. Hidalgo, I have received a specimen from Santona, Aragon, as a co-type of the shells described as possessing apple-green bands, but this colouring, though probably faded with time, must have in great part been due to the body of the mollusk when alive showing through the thin pale yellow shell.

VARIATIONS IN COLOUR OF LIP OR PERISTOME.

In this section are placed the various colours of aperture, which range from the deepest black, through brown, purple, pink, and yellow, to the purest white. The typical form, which has a black or deep-brown aperture, has been distinguished as var. *nigrolabiata* by Wright, and as var. *melanostoma* by Coutagne. The var. *transalpina* Stabile also appears to be the ordinary dark-lipped form of the species.

Var. *albilabris* Dumont and Mortillet.

Helix nemoralis var. *albilabris* Dum. and Mort., Moll. Savoie, 1857, p. 84.

Helix nemoralis var. *leucostoma* Stabile, Prosp. Moll. Lugano, 1859, p. 26.

Helix nemoralis var. *albolabiata* von Martens in Albers' Heliceen, 1860, p. 131.

Helix nemoralis var. *albolabris* Crowther, Science Gossip, Jan. 1883, p. 6.

SHELL with peristome and rib white.

The var. *leucostoma* has an unicolorous yellow shell and white aperture.

The sub-var. *albolabris* of Crowther is described as of typical form and colouring, but with lip and rib white.

It includes the sub-var. *leucostoma fascotrifasciata* of Pirona.

The var. *albolabiata* of Westerlund is not referable to this variety, but to var. *fuscolabiata*, being described as characterized by a pale liver coloured peristome.

The albolabiata variety would seem, judging from its abundance on the confines of its range, to be one of the earliest and most primitive forms of the species, and is frequently difficult to discriminate from *H. hortensis* when identified by the shell alone.

ENGLAND AND WALES.

Cornwall W.—Helston, May 1908, J. R. le B. Tomlin. Near Porthleven, Aug. 1900, Rev. J. W. Horsley.

Devon S.—Topsham! E. Collier. Sidmouth, April 1898, Guy Breeden.

Hants. N.—Ditcham woods, Aug. 1896, C. E. Wright.

Sussex W.—Lavant, May 1904, Rev. W. A. Shaw. Ratham, Aug. 1883! W. Jeffery.

Kent E.—Folkestone! Mrs. Fitzgerald.

Surrey—Haslemere, C. Pannell, junr.

Hunts.—Abbott's Ripton, April 1909! Rev. R. Ashington Bullen.

Northampton—Peterborough and Eye, T. W. Bell. East Haddon, J. E. Roberts. Dorton, Rev. W. A. Shaw. Railway bank, Barford, Aug. 1896, C. E. Wright.

Gloucester E.—Cheltenham (Webster, Naturalist, 1854, p. 175).

Stafford—Weaver Hills, Cheadle, J. R. B. Masefield; and Hall Dale, near Warstow, Lionel E. Adams.

Glamorgan—Penally, H. R. Wakefield. Cardiff, F. W. Wotton.

Lincoln N.—North Ormsby, and Monk's Dyke Side, 1900, C. S. Carter.

- Leicester and Rutland**—Morecott, E. Collier.
Derby—Winnats Pass, May 1906, R. Cairns. Dovedale, Aug. 1892 ! F. Collier.
Matlock, J. A. Howe. **Repton**, J. Hagger.
York S.E.—Bridlington, Rev. W. C. Hey; Wressle, G. Roberts; Ridgmont, Hedon, and Sledmere, T. Petch. Hornsea Cliffs, Aug. 1881, J. D. Butterell.
York N.E.—Binnington and Flixton, J. A. Hargreaves. Old chalk-pit on the wolds near Scarborough (W. Gynge, Sci. Goss., 1901).
York Mid W.—Sub-var. *albolabris*, Leeds district, H. Crowther, l.c.
Cumberland—On the New Red Sandstone cliffs, St. Bees, Aug. 1884 ! Hugh Richardson. Bassenthwaite, W. J. Farrer.
Isle of Man—Douglas, F. Taylor. Port St. Mary ! G. C. Spence. SCOTLAND.
Main Argyle—Oban, 1850, T. Glover. Loch Awe, W. H. Heathcote.
Cantire—Loch Tarbert, July 1886, T. Scott.

- IRELAND.
Antrim—Sandhills, Portrush, April 1907 ! F. H. Sikes. Island Magee, Rathlin Island and Ballycastle, 1897, R. Welch.
Donegal—A colony of a small form (often mistaken for *H. hortensis*) within a limited area on the siliceous dunes, Maghery Ardara, April 1900; also very plentiful in a small form on Bunbeg sandhills, 1909; abundant on sandhills, Horn Head; also found on Muckross Head and Bundoran, 1900, R. Welch. Carrickfin and Bunbeg, Sept. 1908, E. Collier. Tory Island, July 1910, A. W. Stelfox and R. Welch.
Kildare—Kildare ! R. M. Christy.
Sligo—Island of Innishmurry, E. Collier.
Galway W.—Killeany, Aranmore, July 1895, R. Standen. The specimens were all of the yellow form, and usually showed dark coalescent banding.
Clare—Ballyvaughan (12345) and (123)(45), Aug. 1894, E. Collier.
Limerick—Very abundant on nettles along bank of intake of river Shannon at Limerick, July 1908, R. Welch.
Tipperary S.—Near Clonmel, April 1888, Rev. A. H. Delap.
Kerry—Rectory grounds, Valentia Island, with broad black peripheral band, also with formula (123)45, E. Collier and Miss Delap.

CONTINENTAL DISTRIBUTION.

- Germany**—Recorded from North Germany by A. Schmidt; from Detmold by Boreherding; and from Hanau by Prof. E. von Martens.
Belgium—Common in a field at Houraing, Hainault, T. LeComte.
France—Recorded from Basses Pyrénées in Valley d'Ossan, by Mermet; reported from Lerans, near Pau, by Rev. J. W. Horsley; and found by Lieut.-Col. Parry at an elevation of 2,200 feet at Eaux Chaudes. Common at an altitude of 3,000 feet, Eaux-Bonnes, Hautes Pyrénées; and Collonges and on the hills about Oulins, Rhône (Locard, Mal. Lyonn., 1877, p. 30). Found commonly about Tarascon and Ax, Ariège, May 1889 ! W. Eagle Clarke.
Spain—Republic of Andorra, May 1889 ! W. E. Clarke.
Italy—Recorded as rare in Piedmont at Dronero; and found also in the Valle di Scrivia, according to Mortillet. Dr. von Martens records it from Verona, Lombardy. Sub-var. *leucostoma* is cited from Lombrici, Tuscany, by Dr. del Prete; sub-var. *leucostoma fuscotrifasciata*, 00345, by Prof. Pirona from Udine, Venetia; and sub-var. *flavescens, labro alba* from Lugano, Lombardy, by Abbe Stabile.
Switzerland—Zweilutschinen, Canton Berne ! J. H. Ponsobly.

Var. *luteolabiata* Cockerell.

Helix nemoralis var. *luteolabiata* Cockerell, Science Gossip, Sept. 1896, p. 137.

Peristome and rib yellow or yellowish.

- ENGLAND AND WALES.
Cornwall W.—Newquay and Truro, Sept. 1886, J. H. James. Porthleven, Aug. 1900, Rev. J. W. Horsley.
Kent E.—Deal, local, with a thick chrome yellow lip (J. W. Horsley, Brit. Nat., 1891, p. 17).
Northampton—Catesby, Oct. 1899, C. E. Wright.
Pembroke—Manorbier, Tenby, A. G. Stubbs.

IRELAND.

- Donegal**—Cruit Island, Tramore, and Bunbeg dunes, Sept. 1908 ! C. E. Wright.
Clare—Ballyvaughan, Aug. 1894 ! E. Collier.

CONTINENTAL DISTRIBUTION.

- Germany**—Recorded from North Germany by A. Schmidt.
Belgium—Heyst, West Flanders, M. Mournalon.

Var. *roseolabiata* Kobelt.

Helix nemoralis var. *roseolabiata* Kobelt, Fauna Nassau, 1871. p. 124.

Helix nemoralis var. *roseolabiata* Taylor, Journ. of Conch., 1883, p. 33.

Peristome and rib of a rosy-pink.

The var. *roseolabiata* Taylor was originally described as possessing a rosy-red or pale brown lip, but is now restricted to shells with a rosy-pink lip.

ENGLAND AND WALES.

Channel Isles—Fort Doyle, Guernsey, and Alderney (Tomlin & Marquand, l.c.).
Cornwall W.—Truro, May 1886, J. H. James. Falmouth, Rev. A. M. Norman.
Devon S.—Sidmouth, April 1898, Guy Breeden. Teignmouth, Aug. 1888, L. St. G. Byne.

Devon N.—Three specimens only of var. *rubella*, Ilfracombe, Aug. 1903; Barnstaple, Lynton, Braunton, and Mortehoe, H. Beeston and C. E. Wright.

Somerset N.—Rare at Wells, lip and throat peach-coloured, Rev. A. M. Norman. Blagdon and Bitton, Bath! Miss F. M. Hele.

Hants. S.—Hayling, April 1898; and Ditcham Park, April 1898, C. E. Wright.

Sussex E.—Local, Lewes, J. H. A. Jenner.

Kent E.—Sandhills, Deal, Rev. J. W. Horsley.

Essex N.—Near Chelmsford, R. M. Christy.

Middlesex—Islington, 1851! J. Ray Hardy.

Norfolk E.—Alpington, Rev. S. Spencer Pearce. Earlham, A. Mayfield.

Suffolk W.—Long Melford, G. T. Rope.

Northampton—Haselbeech, May 1904; Harrington, Aug. 1904; and Blisworth, June 1906, Rev. W. A. Shaw. Rockingham and other localities in the county, C. E. Wright. Peterborough, T. W. Bell.

Stafford—Weaver Hills, near Cheadle, J. R. B. Masefield.

Glamorgan—Penally, H. R. Wakefield.

Pembroke—Gumfreston and Manorbier, rare, A. G. Stubbs.

Denbigh—Morfa, Llandudno, J. R. le B. Tomlin.

Lincoln S.—Canwick, July 1907, J. F. Musham.

Lincoln N.—North Ormsby and Mablethorpe sandhills, 1900; Monk's Dyke side, May 1900, C. S. Carter. Bardney, Sept. 1908, J. F. Musham. Lime quarries, Lincoln, June 1895, C. E. Wright. Boston, W. H. Hay.

Derby—Miller's Dale, C. H. Moore. Dovedale, Aug. 1892! F. Collier.

York S.E.—Selby! G. Roberts. Lowthorpe and Halsham road, Ridgmont, Tom Petch.

York N.W.—Croft near Darlington, June 1893! C. Oldham.

York S.W.—Kirk Smeaton, May 1908! W. E. Brady.

York Mid W.—Rombald's Moor near Ilkley, F. W. Fierke. Selby! G. Roberts.

Durham—Lanchester, April 1902! H. S. Whittfield.

Cheviotland—Alnmouth, north of the Aln, rare, Rev. Dr. McMurtrie.

Westmorland and Lake Lancashire—Hampsfell, H. Beeston.

Cumberland—Bassenthwaite, W. J. Farrer.

Isle of Man—Douglas road, Peel, Aug. 1892, R. Cairns.

SCOTLAND.

Haddington—Rare, North Berwick, Rev. Dr. McMurtrie.

Edinburgh—West Coates near Edinburgh (Brown, Brit. Shells, 1845, p. 57).

Fife—St. Andrew's! W. Evans.

Cantire—Old castle, East Loch Tarbert, T. Scott.

IRELAND.

Donegal—Bundoran, April 1908! F. H. Sikes. Tory Island, July 1910, A. W. Stelfox and R. Welch.

Galway W.—Killeany, Aranmore, July 1895, R. Standen.

Clare—Ballyvaughan, Aug. 1894! E. Collier.

Tipperary S.—Clonmel, Rev. A. H. Delap.

Kerry—Near upper lake, Killarney, June 1885, 1(23)45! W. F. de Vismes Kane.

FOREIGN DISTRIBUTION.

Germany—Recorded for North Germany by A. Schmidt; by Dr. Kobelt and Dr. Goldfuss for the neighbourhood of Frankfort; by Prof. von Martens from Hanau; and collected by F. Fitzgerald at Geisenheim, Nassau.

France—M. Magot records this variety from d'Aulus Valley, Ariège; and Mr. F. H. Sikes has found it about Trouville, Calvados.

Austro-Hungary—Carinthia (Westerlund).

Denmark—Dr. Westerlund records this variety from Denmark.

United States—Lexington, Virginia, Prof. Morrison (Cockerell, l.c.).

Var. violaceolabiata Taylor, var. nov.

SHELL with lip of a purple or violet tint.

ENGLAND.

Dorset—Charminster, 1889 ! T. F. Burrows.

IRELAND.

Donegal—Var. *libellula* 12345, (123)(45), 1(23)45, (12)345 and 00000, also sub-var. *aurantia* 00000, Tory Island, July 1910, A. W. Stelfox and R. Welch.

CONTINENTAL DISTRIBUTION.

France—Recorded by Mermet from Basses Pyrénées.

Switzerland—Recorded from Canton Ticino by Hartmann.

Var. fuscolabiata Taylor, var. nov.*Helix nemoralis* var. *albolabiata* Westerlund, Fauna Moll. Extram., 1878, p. 116.

Peristome and rib of a pale brown colour.

The sub-var. *albolabiata* of Westerlund has a deep straw-yellow unicolorous shell with a pale liver coloured rib.

ENGLAND AND WALES.

Dorset—Swanage, Aug. 1884 ! Charles Ashford.

Hants. S.—Romsey, July 1891, Rev. W. L. W. Eyre.

Sussex E.—Lewes, Oct. 1899, C. E. Wright.

Kent E.—Walmer, Ewell, Minster and St. Margaret's, Sept. 1900, C. E. Wright.

Berks.—Maidenhead ! Lionel E. Adams.

Suffolk E.—Gorleston, July 1899, C. E. Wright.

Norfolk E.—Earlham ! A. Mayfield.

Northampton—Woodford and Kettering, C. E. Wright.

Stafford—Stafford ! Lionel E. Adams.

Salop—Porthywaen quarries, 1863 ! W. Whitwell.

SCOTLAND.

Roxburgh—Minto near Hawick ! W. Grant Guthrie.

IRELAND.

Galway W.—Dog's Bay, Roundstone, Nov. 1898, C. E. Wright.

CONTINENTAL DISTRIBUTION.

France—Tarascon and Ax, Ariège, May 1889 ! W. E. Clarke.

Denmark—Dyrehavskov, near Nyborg, Funen ; and Taarnberg, near Korsør, Bornholm (Westerlund, l.c.).

Var. bimarginata Picard.*Helix nemoralis* var. *bimarginata* Picard, Moll. Somme, 1840, p. 186.*Helix nemoralis* var. *marginata* Westl., Exp. Crit. Moll. Suède et Norv., 1871, p. 39.

SHELL with a brown (or dark) peristome, bordered interiorly by a milk-white rib.

The sub-var. *marginata* Westerlund, is practically identical.

ENGLAND AND WALES.

Channel Isles—Pleinmont and Jerbourg, Guernsey, also in Alderney and Sark (Tomlin and Marquand, l.c.).

Devon S.—Plentiful, Teignmouth, L. St. G. Byne. Near Exeter, E. D. Marquand. Torquay, 1884, B. M. Oakeshott.

Devon N.—About Ilfracombe, Lee, Braunton, Mortehoe and Lynton, Aug. 1903, H. Beeston and C. E. Wright.

Kent W.—Chislehurst, Aug. 1885 ! T. D. A. Cockerell.

Northampton—Not uncommon, Lionel E. Adams. Rockingham, July 1896, C. E. Wright.

Pembroke—North Cliff, Tenby, A. G. Stubbs.

Anglesey—Cemmaes near Amlwch, July 1895, C. Oldham.

Lincoln N.—Hubbard's Valley, Louth, Aug. 1902, C. S. Carter. Bardney, Aug. 1906, J. F. Musham. Little Cotes, Sept. 1902 ! W. Denison Roebuck.

Derby—Miller's Dale and Winster, Rev. H. Milnes. Repton and Dovedale ! J. Hagger.

Lancashire Mid—Morecambe, Aug. 1905, H. Beeston.

York S.E.—Driffild, L. B. Ross. Hedon, T. Petch.

York Mid W.—Boston Spa, John Emmet. Selby ! George Roberts.

Cheviotland—Bamburgh, Rev. Dr. McMurtrie.

Westmorland and Lake Lancashire—Hampfell, H. Beeston.

Isle of Man—Scarlet Point near Castleton, Sept. 1891, E. Collier.

SCOTLAND.

Haddington—North Berwick, Rev. Dr. McMurtrie.

IRELAND.

Clare—Ballyvaughan, also one with a tricoloured lip, Aug. 1894, E. Collier.

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *marginata*, plentiful only at Miesbach, Bavaria (Clessin, Exc. Moll. Deutsch., 1884, p. 207); and recorded by Meyer from Alsace.

France—Recorded for the Somme by Picard; and from d'Aulus Valley, Ariège, by Fagot.

Sweden—Sub-var. *marginata*, Möllevängen, nr. Malmö, Skane (Westerlund, l.c.).

MONSTROSITIES.

In this group are included all pathological anomalies, scalariform and reversed shells. The *Helix nemoralis carinata* cited (without description) by Meyer, from Colmar, Alsace, may possibly be referable to this section.

Monst. *scalare* Férussac.

Helix nemoralis monst. *scalaris* Férussac, Tabl. Syst., 1821, p. 35, pl. 32a, f. 2.

Helix nemoralis var. *pseudo-scalaria* Locard, Mal. Lyon., 1877, p. 30.

SHELL with more or less dislocated whorls.

ENGLAND.

Cornwall W.—Truro! J. H. James.

Northampton—Weston Favell, Lionel E. Adams.

Kettering, April 1898, C. E. Wright.

Leicester and Rutland—Canal bank, Leicester, March 1895, C. E. Wright.

Lincoln N.—Lime quarry, Lincoln, July 1898, C. E. Wright.

Lancashire S.—Several on the sandhills between Southport and the mouth of the river Ault at Hightown, and at Ainsdale near Southport, Robert Drummond. Near Burnley, J. Russell Wildman.

Lancashire Mid.—Several on the sandhills north of Blackpool, R. Drummond.

York N.E.—Carnaby, near Scarborough, Rev. W. C. Hey.

Cheviotland—Alnmouth, Rev. Dr. J. McMurtrie.

IRELAND

Donegal—Fenner sand dunes, Bundoran, R. Welch. Fairy Bridges, W. A. Green. Ballyshannon! W. Swanston.

FOREIGN DISTRIBUTION.

France—Var. *scalaris* Boubée, reported by Dr. Grateloup from Toulouse and the Hautes Pyrénées. Sub-var. *pseudo-scalaria*, very rare about Lyons (Locard, l.c.).

Belgium—Glons-sur-Geer, Liège, M. L. de Koninck.

United States—Two fine scalariform shells with formulæ 00000 and 12045 reported from Lexington, Virginia, by Mr. G. H. Clapp.



FIG. 368.—*Helix nemoralis* m. *scalare* Fér. (Truro, Cornwall).

Monst. *sinistrum* Férussac.

Helix nemoralis monst. *sinistra* Férussac, Tabl. Syst., 1821, p. 35, pl. xxxiv., ff. 8, 9.

Helix nemoralis var. *contraria* Charpentier, Moll. Suisse, 1837, p. 7.

Helix nemoralis var. *senestra* Locard, Mal. Lyonn., 1877, p. 30.

Helix nemoralis monst. *sinistrorsum* Taylor, Journ. of Conch., 1892, p. 52.

SHELL reversed or sinistral in coiling.

ENGLAND AND WALES.

Sussex W.—Chichester, J. C. Melvill.

Middlesex—Railway-bank, West Drayton, Sept. 1888, F. G. Fenn.

Norfolk E.—Specimen in the Norwich Museum, labelled "Old Lakenham churchyard, J. Chittock."

Northampton—Bradfield, April 1904, Rev. W. A. Shaw.

Lancashire S.—One immature shell—var. *libellula* 12345—found by Mr. F. C. Long in July 1889 near the "Tim Bobbin Inn," Burnley; a fully mature example—var. *libellula* 12(345)—was found near Low Moor, Clitheroe, by Mr. Wigglesworth in June 1897, and Mr. R. Drummond has taken four specimens on the sand hills between Southport and the mouth of the river Ault, Hightown.

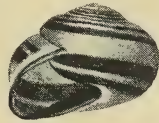


FIG. 369.—*Helix nemoralis* m. *sinistrum* (Bundoran, Donegal).

Lancashire Mid—Three on the sandhills north of Blackpool, R. Drummond.
York Mid W.—Near summit of Fountains Fell ! S. L. Mosley.

Main Argyle—An unusually solid specimen near Oban, J. Ray Hardy. SCOTLAND.

Antrim—Ballycastle, J. Wilfrid Jackson. IRELAND.

Donegal—A local race of reversed shells of this species must at one time have existed on the Fenner dunes, Bundoran, as Mr. Welch has records of nearly 2,000 specimens, mostly Holocene fossils, obtained there. Ballyshannon, W. Swanston.

Dublin—Specimens in the Dublin Museum, labelled "Malahide."

Galway W.—Holocene fossil specimen, with formula 12045, Dog's Bay, Roundstone, C. E. Wright.

Clare—Gleninagh Castle, Gregg near Ballyvaughan, Aug. 1894, E. Collier.

CONTINENTAL DISTRIBUTION.

Germany—Recorded by Dr. Kobelt from Schlossberg near Biedenkopf, Nassau; by A. Schmidt from Aschersleben, Anhalt, and Bonn in Rhenish Prussia; and by H. Schlessch at Rodding, Schleswig.

Belgium—Var. *rubello-libellula* 00000, Pietrebais, Brabant; and 00300, Ostend, West Flanders; Jules Colbeau. Two specimens, var. *libellula* (12)0(45), and sub-var. *brunnea* 00000, found near Brussels by M. Timmermans.

France—Aigueperse, Puy de Dôme (Bouillet, Moll. Auvergne, 1836, p. 31). Sub-var. *senestra*, Lyons (Locard, l.c.). Toulouse, Haute Garonne, J. B. Noulet.

Italy—One, var. *libellula* 00000 by Porta Ticinese, Milan, in 1850, recorded by Abbe Stabile; and var. *libellula* 12345 by Dr. del Prete from Camaiore, Tuscany.

Switzerland—A specimen taken by M. Th. Studer is recorded by M. Charpentier. Corbeyrier sur Aigle, Vaud, July 1902, E. Collier.

Geographical Distribution.—*Helix nemoralis* is, like *H. pomatia*, a characteristic and dominant Mid-European species, but has a wider range, as it naturally inhabits a compact and increasing geographical area in Europe, ranging from Poltava in Russia on the east, to Portugal on the west, and from Spain and Italy in the south, to Jemtland in Sweden in the north, the advance guard steadily extending its territory and gradually dispossessing from the regions they occupy, the closely-allied yet earlier evolved and therefore comparatively weaker and less dominant species *Helix austriaca*, *H. sylvatica*, and even *H. hortensis*.

Those sub-dominant and competitive species are naturally most plentiful and still supreme in the regions to which *Helix nemoralis* has not yet penetrated, but they gradually become isolated within restricted or less favourable districts and increasingly less numerous within the territories encroached upon or already occupied by the more dominant *H. nemoralis* which, more especially in the north, invades the territory and restricts the range of *H. hortensis*, in the east that of *H. austriaca* and in the alpine regions of the south that of *H. sylvatica*.

M. Bourguignat and others have erroneously assumed that this species originated on the Central Asian plateau, and extended its range westwards along the mountain chains, modifying in its course to form a number of different species; while Dr. R. F. Scharff, on the contrary, maintains its birthplace to be South-Western Europe.

As in *H. pomatia*, its true evolutionary area is, however, decidedly within the Germanic region, from whence it has spread and is gradually spreading in all directions, penetrating eastwardly through the South Russian provinces by precisely the same route as that species, thus contributing to confirm this as the true easterly migratory track of the dominant European species, as maintained in this Monograph.

Distribution of *Helix nemoralis* Linné

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.





Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilts N.	48 Merioneth
8 Wilts S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
SURREY	MERSEY
17 Surrey	58 Cheshire
18 Essex S.	59 Lancashire S.
19 Essex N.	60 Lancashire Mid
20 Herts.	61 S.E. York
21 Middlesex	62 N.E. York
22 Berks.	63 S.W. York
23 Oxford	64 Mid W. York
24 Bucks.	65 N.W. York
ANGLIA	66 Durham
25 Suffolk E.	67 Northumb. S.
26 Suffolk W.	68 Cheviotland
27 Norfolk E.	LAKES
28 Norfolk W.	69 Westmorland
29 Cambridge	and L. Lanes.
30 Bedford	70 Cumberland
31 Hants.	71 Isle of Man
32 Northampton	
SEVERN	
33 Gloucester E.	
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easternness
76 Renfrew	W. HIGHLANDS
77 Lanark	97 Westernness
E. LOWLANDS	98 Main Argyle
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Shudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Pth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

-  Probable Range.
-  Recorded Distribution.
-  Distribution verified by the Author.
-  Geological Distribution.

The greater abundance of the albolabiate form, and the strikingly manifest tendency of the species to assimilate in external aspect to *Helix hortensis* as the confines of its area of distribution are approached, lead not only to its confusion with that species, but also to the inference that it is the earliest evolved and most primitive of the existent forms of the species, approaching more closely the common ancestor of the *Pentatenuia*.

In the British Isles, this species is diffused over England, Wales, and Ireland, but in Scotland it has not yet been found north of Kincardineshire on the east coast, nor higher than the Isle of Lismore on the west, its place further north being filled by its predecessor and close ally *Helix hortensis*.

The record for the Hebrides was based on a single immature shell referred to this species, found by Mr. Alexander Somerville in Sept. 1886 in the old churchyard at Eye, near Stornoway.

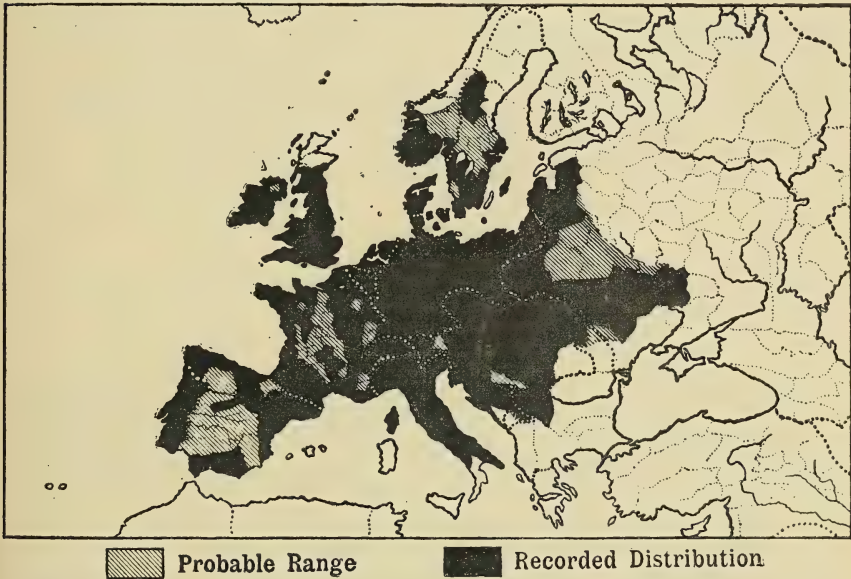


FIG. 370.—Geographical Distribution of *Helix nemoralis* Linné.

GERMANY.

Apparently distributed over the whole empire and has been reported from Alsace, Baden, Bavaria, Brandenburg, Brunswick, Cassel, Franconia, Hanover, Hesse-Darmstadt, Holstein, Lorraine, Luneburg, Mecklenburg, Nassau, Oldenburg, Pomerania, East, West, and Rhenish Prussia, Saxony, Schleswig, Silesia, Suabia, Thuringia, Wurtemberg, and Posen, in which latter province as in many parts of south-eastern Europe *H. austriaca* is still the more abundant species.

FRANCE.

In France, it has not yet been recorded from many of the central departments, but is known to occur in Ain, Aisne, Allier, Alpes Maritimes, Aquitaine, Ardennes, Ariège, Aube, Aude, Auvergne, Basses Alpes, Basses Pyrénées, Bouches du Rhône, Calvados, Charente Inférieure, Côtes du Nord, Côte d'Or, Drôme, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Marne, Hautes Pyrénées, Haute Loire, Haute Savoie, Hérault, Indre-et-Loire, Ille-et-Vilaine, Isère, Landes, Loire Inférieure, Lot-et-Garonne, Lozère, Maine-et-Loire, Manche, Meuse, Morbihan, Moselle, Nièvre, Nord, Oise, Orne, Pas-de-Calais, Puy-de-Dôme, Pyrénées Orientales, Rhône, Saône-et-Loire, Sarthe, Savoy, Seine, Seine Inférieure, Seine-et-Marne, Seine-et-Oise, Somme, Tarn, Tarn-et-Garonne, Var, Vaucluse, Vendée, Vienne, Vosges, Yonne, and is cited for the island of Corsica by M. Payraudeau, but its occurrence there is doubted by modern authorities.

NETHERLANDS.

Belgium—Found throughout the country, and recorded from the provinces of Antwerp, Brabant, East and West Flanders, Hainault, Liège, Limburg, Luxemburg, and Namur.

Holland—Records known only from Friesland, Gelderland, Groningen, North Brabant, South Holland, and Zeeland.

ITALY.

Found almost throughout the whole of Italy, though Strobel states its southern limit to be the province of Emilia. Records are, however, available from Abruzzi, Apulia, Emilia, Liguria, Lombardy, the Marches, Piedmont, Rome, Tuscany, Umbria, Venetia, and the island of Sicily. The record from Apulia is based upon examples from the south of the province in the museum at Bologna, and that of Sicily upon a single shell said to have been found on Mont Gargotta near Termini.

SPAIN AND PORTUGAL.

Spain—Apparently distributed over the whole kingdom, but records have been seen only from Aragon, Andalusia, Asturias, Basque provinces, Catalonia, Galicia, Old Castile, Valentia, and the republic of Andorra. It has also been cited by Ramis for Minorca, but according to Dr. Hidalgo erroneously.

Portugal—Recorded by Morelet as existing almost throughout, becoming rarer towards the south, and as not known to inhabit the Algarve, but it has recently been recorded therefrom by Dr. Kobelt. Records are actually known from Beira, Alemtejo, Algarve, Douro, Estremadura, and Tras-os-Montes.

BALKAN PENINSULA.

Servia—Recorded by Dr. Westerlund.

AUSTRO-HUNGARY.

In Austro-Hungary, where it reaches the limits of its eastern distribution in Central Europe, its distributional area gradually blends with that of its closely-allied subdominant predecessor *Helix austriaca*, whose metropolis lies east of that of the present species. *H. nemoralis* has been recorded for Austria, Bohemia, Bosnia, Carniola, Carinthia, Croatia, Dalmatia, Galicia, Goritz, Hungary, Illyria, Istria, Moravia, Silesia, Styria, and Tyrol. In Transylvania, it is replaced by *Helix austriaca*.

SWITZERLAND.

Diffused throughout the country, records existing for the Cantons Aargau, Appenzell, Basle, Berne, Geneva, Grisons, Lucerne, Neuchâtel, Schaffhausen, Schwyz, St. Gall, Solothurn, Thurgau, Ticino, Unterwalden, Uri, Valais, Vaud, Zug, and Zurich.

SCANDINAVIA.

Norway—Only found on the west coast; at Sandvigen, in the cemetery of the Cathedral of Bergen, and Ullensvang on the Hardangerfjord in Bergen Stift, and Stavanger in Christiansand Stift.

Sweden—It is found in the southern parts of Sweden, and extends as far north as Jemtland. It is recorded from Malmö, Skane; Carlskrona, Blekinge; in gardens and cemeteries at Kalmar, Småland; Göteborg, on the eastern slope of Mount Billingen, in Hellekis and in "Räbäks Munkånger" on Mount Kinnekulle, Westergötland; about Stockholm, Haga, and Drottningholm; Wisby and Rosendal in the Island of Götland; and Oviken in Storsjön, Jemtland (Westerlund, l.c.).

Herr Hägg has regarded the presence of this species in Jemtland as an evidence of a relict fauna which, owing to a warmer period in early quaternary times, extended further north than is shown by the continuous distribution of the present day.

He quotes it from Skane as found in post-tertiary calcareous tufa at Benestad; in limestone and tufa at Mellby; in tufa at Mossby; in black sand at the base of a submarine peat deposit in the Harbour of Ystad; and as not found in any of the quaternary deposits north of Skane.

Denmark—Dispersed throughout Jutland and the islands.

RUSSIA.

Existing chiefly in Western and Southern Russia, and specially recorded for Courland, Livland, Kiev, Lithuania, Podolia, Poland, Poltava, and Volhynia.

In Finland, according to Luther, it was introduced artificially with fruit trees at Helsingfors, and is now plentiful in the gardens and parks of the neighbourhood.

NORTH AFRICA.

Algeria—*H. nemoralis* from Loche, Algeria, cited in 1869 by Dr. Kobelt.

NEARCTIC REGION.

The presence and distribution of *Helix nemoralis* on the Nearctic continent is solely due to its artificial introduction from Europe.

It is a species far more advanced in organization than most of those with which it is brought into contact, and will probably continue to extend its range.

CANADA.

It is recorded as introduced into the dominion from Lourdes, Hautes Pyrénées, and as prospering.

UNITED STATES.

Colorado—Prof. Cockerell has recorded the introduction of this species at West Cliff, Custer co., from Burlington, New Jersey.

Massachusetts—Reported from Cape Ann by Mr. Bryant Walker.

New York—Reported by Mr. H. Prime from Flushing, Long Island, and Astoria. A colony formerly lived at Lloyd's Neck, but the locality is now a public picnic-ground.

Pennsylvania—Blairsville, introduced from Lexington, Virginia (J. L. Howe, Amer. Nat., 1898, p. 913).

Winconsin—Reported by Dr. Pilsbry from Baraboo Creek, Sauk co.

New Jersey—Introduced from Sheffield, England, during 1857, into his garden at Burlington, by Mr. W. G. Binney.

Virginia—Introduced into Lexington, and now plentiful.

AUSTRALASIAN REGION.

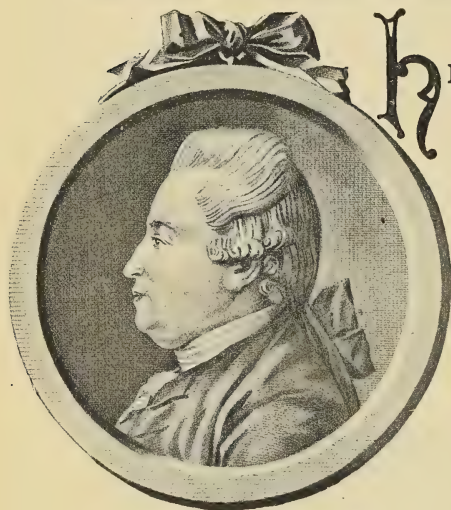
New Zealand—Recorded from Auckland in the North Island by Capt. Hutton.



FIG. 371.—Thrush's altar, Spurn Point, Yorkshire, July 1904 (after photo. by Mr. Godfrey Bingley).

Helix hortensis Müller.

- 1758 *Helix nemoralis* L., (pars) Syst. Nat., ed. x., vol. i., p. 773, no. 604.
 1774 **Helix hortensis** Müller, Verm. Hist., ii., p. 52, no. 247.
 1801 — *hybrida* and *fusca* Poiret, Coq. Aisne, p. 71.
 1821 — *mutabilis* var. *a* Hartmann, Neue Alpina, i., p. 242.
 1837 — *subglobosa* Binney, Boston Journ. Nat. Hist., i., p. 485, pl. xvi., f. 7.
 1862 — *nemoralis* var. *hortensis* Jeffreys, Brit. Conch., i., p. 186.
 1778 *Cochlea fasciata* DaCosta, Test. Brit., p. 76, pl. v., f. 4-5.
 1836 *Acavus hortensis* Kryn., Hel. Ross., ix., p. 162.
 1837 *Helicogena hortensis* and *hybrida* Beck, Index Moll., p. 39.
 1837 *Cepea hortensis* Held, Isis, p. 910.
 1852 *Tachea hortensis* Leach, Synopsis, p. 62.



O. Müller

HISTORY.—*Helix hortensis* (*hortensis*, living in gardens) was included with *H. nemoralis* by Linné and for more than a century this view was almost universally accepted, but its specific status is now firmly established by the differences demonstrated to exist in its organization.

Dr. Gray has accredited to Dr. Martin Lister the introduction of this species to the British fauna, and Mr. E. A. Smith informs me that pl. 57, f. 54, of Lister's "Historiæ sive synopsis methodicæ conchyliorum," published in 1685, depicts six shells collectively indicated by the term *Cochlea interdum unicolor, interdum variegata, item uarijs fasis depicta*, of which one undoubtedly represents a white-lipped shell, while the remaining five are clearly the darker-lipped form known as *Helix nemoralis*.

Dr. Amos Binney, thinking it probable that the American specimens were distinct from the European species, applied the name *subglobosa* to them.

This species is dedicated to Otto F. Müller, the celebrated Danish naturalist, who first differentiated it from *Helix nemoralis*, with which species it was combined by Linné and most subsequent authors.

Diagnosis.—*H. hortensis* is distinguished from *H. nemoralis* by its smaller size, more globose shape, white aperture, and thinner and more glossy shell; moreover there is much less band variation, there is a larger proportion of bandless and 5-banded shells, and the commonness or rarity of the band formulæ is quite different in the two species.

INTERNALLY, the differences are striking, the chief divergence being the structure of the gypsobelum or "love-dart," which, in place of presenting the four simple longitudinal blades with connecting crescentic films, as in *H. nemoralis*, has the four blades deeply cleft and widely reflected along their entire length, forming thus eight sharp divaricating blades; there are also no crescentic films between the blades, which terminate abruptly at the base, and not gradually, as in *H. nemoralis*; the vaginal mucus glands are also usually more branched than in *nemoralis*, and instead of being simply and uniformly digitate, are swollen or sacculate at the extremities.

Description.—The ANIMAL is very variable in colour, but is usually dark greenish-grey, with a well defined pair of longitudinal DORSAL GROOVES, enclosing a well defined row of TUBERCLES of a paler tint than the markedly darker subdorsal shade bordering them, which pales rapidly towards the foot. There are about sixteen oblique rows of tubercles at each side of the body from the dorsal groove to the foot fringe; GENITAL GROOVE distinct, often forming a boundary to the darker pigmentation; SOLE greyish yellow; MANTLE sometimes distinctly yellowish or translucent grey with yellowish specks, tail and hinder part pale, often lemon-yellow; OMMATOPHORES long and slender, and nearly four times the length of the lower tentacles, slightly bulbous at the end, with black eye specks; the dark RETRACTORS showing through the skin.

SHELL sub-globose, comparatively thin and pellucid, glossy with delicate transverse striation, usually yellow in colour with or without five dark revolving bands; SPIRE bluntly pointed, somewhat elevated; WHORLS about five, convex in form, and increasing progressively in size; SUTURE rather deep. APERTURE oblique, bordered by a white rim and a submarginal white rib encircling the aperture. UMBILICUS open in the young, but becoming closed in adult life.

Diam. 18 mill.; alt. 15 mill.; and the average weight is nearly six grains, but varying from two grains to ten or even more.

The EPIPHRAGM is usually very thin, somewhat transparent and iridescent in parts, but with numerous calcareous particles intermingled in its substance, which become concentrated opposite the respiratory orifice and form an opaque-white spot. In very cold weather it is always thickened, apparently by the addition of one or more layers of mucus, and then becomes dull, opaque and creased, resembling crumpled tracing paper.

The NERVOUS SYSTEM as concentrated around the gullet does not appreciably differ from that of its congeners, but, like them, shows in the immature stage the composite ganglionic structure, which becomes obscured with age.

The OTOCONIA contained in the otocysts are usually oval in shape, and very numerous, but difficult to count, though exceeding a hundred in each capsule.

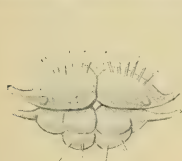


FIG. 373.



FIG. 374



FIG. 375.

FIG. 373.—Pedal and visceral ganglia of *Helix hortensis* as seen from beneath.

FIG. 374.—Nerve ring of *Helix hortensis* as seen from the front, and showing the arrangement of the pedal and visceral ganglia.

FIG. 375.—Varied forms of Otoconia of *Helix hortensis*, highly magnified (after Schmidt).

The REPRODUCTIVE ORGANS resemble generally those of *H. nemoralis*, but present some striking differences. The OVOTESTIS is large and compact; the HERMAPHRODITE DUCT is dirty cream colour, besprinkled with minute deposits of lime, stout and closely convolute in its middle course, but slender at each extremity; the ALBUMEN GLAND is large and very variable in colour, sometimes light green or dirty ochreous-yellow; the CLAW or vesicula seminalis minutely spotted; the OVIDUCT is of a yellowish or buff colour; FREE OVIDUCT or vagina dark brown; PENIS short and blackish-brown in colour, darker basally, the retractor muscle being affixed to the anterior floor of the mantle cavity, a little to the right of the median line; FLAGELLUM long and slender, white with tinge of brown; EPIPHALLUS dark brown. SPERMATHECA small and globose, of a reddish colour, with a very long and slender dark brown stem, from which a short but tumid diverticulum arises towards the summit.

The MUCUS GLANDS are paired structures, and each divides into two branches, which subdivide into two or three other caeca, which may exceptionally again furcate; these mucus glands most frequently show four branches in one group and five in the other, and are not so strictly cylindrical and uniform as in *Helix nemoralis*, but are irregularly swollen, especially towards the extremities; a medial constriction, which is often present, defining the junction of the white and tumid free distal portion with the pale violet or pale pink and more regularly cylindrical basal portion.

The DART SAC, or stylophore, is small and subelavate in shape, and not fused to the vagina, white or whitish when immature, but livid purple or blue when sexually adult; the thick outer coat is of a purplish tint, except towards the base, the inner coat of a purplish-brown, the intervening space being filled by a dark pigmentary deposit; BASAL TUBERCLE with a dark core and a white and probably calcareous tip.

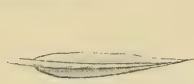


FIG. 376.

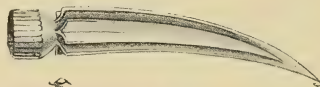


FIG. 377.

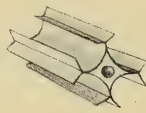


FIG. 378.

The Gypsobelum or "Love Dart" of *Helix hortensis* Müller, showing an immature stage, the perfected weapon, and an enlarged section to more closely reveal its remarkable structure.

FIG. 376.—Immature stage, showing the order of development of the blades, $\times 20$.

FIG. 377.—Gypsobelum or love dart, $\times 10$.

FIG. 378.—Section through lower third of the dart, $\times 20$.

The DART, or gypsobelum, is heterospathostylous¹ and about four mill. in length, curved in shape especially towards the apex, and gradually enlarging towards the base, furnished with four channel-edged blades, placed at right angles to each other, and destitute of the crescentic films between the blades, so characteristic of *H. nemoralis*; the blades originate abruptly a little above the basal expansion, and gradually diminish in size and prominence as they approach the apex, where they are first perfected, the expanded base and the annulus, which is constituted by fourteen to sixteen convex longitudinal rodlets, being formed later.

The HEART shows a comparatively large and white ventricle and a smaller brown auricle, and is, as usual, placed alongside the renal organ or kidney.

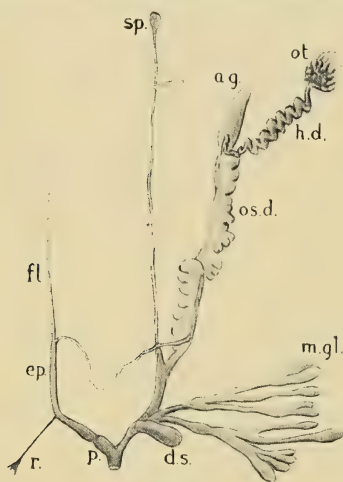


FIG. 379.



FIG. 380.



FIG. 381.



FIG. 382.

The Reproductive, Respiratory and Alimentary organs of *Helix hortensis*.

FIG. 379.—Reproductive system, showing the general arrangement of its constituent organs.

ag. albumen gland; d.s. dart sac or stylophore; fl. flagellum; h.d. hermaphrodite duct; m.gl. mucus glands; ot. ovotestis or hermaphrodite gland; os.d. ovispermato duct; sp. spermatheca; p. penis; r. retractor.

FIG. 380.—Vesicula seminalis and hermaphrodite duct, showing their precise character, $\times 15$.

FIG. 381.—Pulmonary plexus, kidney and heart, $\times 2$. k. kidney; u. ureter; r. rectum.

FIG. 382.—Alimentary organs, $\times 2$. b.b. buccal bulb; s.gl. salivary glands; r. rectum.

The ALIMENTARY SYSTEM is triodromous² in intestinal arrangement, and shows an elongate ŒSOPHAGUS, much longer comparatively than in *H. aspersa*, bluish-grey in colour, and conspicuously marked by dark longitudinal lines; the SALIVARY GLANDS and their ducts are also bluish-grey or slate-coloured, the glands being attached to the Œsophagus and not, as is more usual, to the crop, which is of a dull ochreous colour.

¹ Monog. i., p. 369.

² Monog. i., p. 284, . 567.

The buccal armature of British specimens of this species as here described and figured show such striking differences to American and continental individuals as to merit serious investigation; not only is the jaw different and the total number of teeth on the radula remarkably dissimilar, but the changes in the character of the teeth take place at different positions on the membrane.

The JAW is about two millimetres broad from side to side, and somewhat arcuate from front to back, flatly and widely crescentic in shape, and of a deep fawn colour, with thinner and bluntly-rounded ends, and perceptible striæ and growth lines. The transverse ribs are vertical but slightly divergent, and are very prominent, especially on the anterior face; they are usually three or more in number, medially placed, and strongly denticulating both the upper and cutting margins.

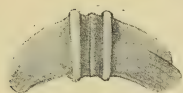


FIG. 383.



FIG. 384.



FIG. 385.

FIG. 383.—Jaw or mandible of an adult *Helix hortensis* from Beverley (from a preparation by Mr. J. Darker Butterell), $\times 12$.

FIG. 384.—Jaw or mandible of an adult *H. hortensis* from Maine, U.S.A., much enlarged (after Prof. E. S. Morse).

FIG. 385.—Jaw or mandible of *H. hortensis*, much enlarged (after Moquin-Tandon).

Moquin-Tandon describes the transverse ribs on the jaw of this species as six in number, although his figure indicates seven, as denticulating the cutting margin, but both figure and description are scarcely representative, as six is an excessively rare number of ribs and seven almost unknown; three more or less distinct ribs is the average number possessed by the species and the usual number present in British specimens.

In 1864 Prof. Morse described and figured the jaw of an adult specimen from Maine, U.S., as possessing upon its anterior surface five stout and well developed vertical ribs, of which the median one is the most prominent; they strongly denticulate both margins, and are restricted to the central portion of the organ.

The RADULA is oblong in shape and about six mill. in length and two mill. in width, and composed of one hundred and fifty or more transverse rows of teeth, each row constituted by ninety-five teeth and composed of an unicuspid and powerful



FIG. 386.—Representative denticles from the radula of *Helix hortensis*, highly magnified (from a preparation by Rev. Prof. H. M. Gwatkin).

central tooth, flanked by a series of about sixteen laterals; the admedian teeth are unicuspid, similar to the median tooth, but gradually becoming more asymmetrical as the teeth recede from the centre, an ectocone becoming perceptible at the thirteenth tooth, and showing a transitional character; the marginals are about thirty in number, and tricuspid in plan, due to the bifurcation of the mesocone, which commences at the seventeenth tooth; towards the margins they, however, occasionally become quadricuspidate by the splitting of the ectoconic points also.

The formula of a Paignton specimen prepared by Rev. Prof. H. M. Gwatkin is

$$\frac{3}{3} \frac{1}{4} + \frac{1}{1} \frac{6}{2} + \frac{1}{1} + \frac{1}{1} \frac{6}{2} + \frac{3}{3} \frac{1}{4} \times 150 = 14,250 \text{ teeth.}$$

Dr. W. G. Binney in 1878 described and figured the radula of an American specimen in which a decisive bifurcation of the mesocone is shown on the eleventh tooth, and the presence of an ectocone is indicated even on the first admedian tooth, and is shown powerful and well developed on the sixth lateral, while the representation of the twenty-sixth denticle is distinctly pentacuspidate.

The radula of an adult specimen from Maine, U.S., prepared and figured by Prof. Morse, showed 116 transverse rows of teeth, with 65 in each row, making a total of 7,540 teeth on the whole membrane. The median row is symmetrical and unicuspid, but modification quickly commences, as a distinct ectocone is shown on the eighth lateral, the teeth gradually merging into tridentate marginals, shown by the bifurcation of the mesocone, which is figured on the sixteenth tooth.



FIG. 387.

FIG. 387.—Representative teeth from the radula of an American specimen of *Helix hortensis*, highly magnified (after W. G. Binney).

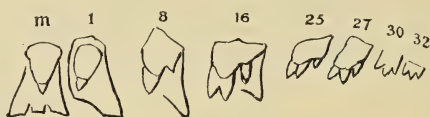


FIG. 388.

FIG. 388.—Representative teeth from the radula of an adult *H. hortensis*, from Maine, U.S.A., highly magnified (after Prof. Morse).

Reproduction and Development.—Practically there is no available information as to the conjugation of this species or of the amours which precede them, but they probably differ only in detail from those of the larger and better known allied species.

The colouring and markings of the snail, if not Epigamic, as suggested by Dr. Beddard, have doubtless some interesting significance, though the probability of colour and markings exercising some sexual influence is shown by Dr. Gain, who observed that in captivity a distinct preference was manifested for pairing with others similarly coloured to themselves.

The eggs are perfectly oval in shape, about 3 mill. in length, and $2\frac{1}{2}$ mill. broad, with an opaque-white and slightly glossy calcareous envelope, bestrewn with innumerable microscopic rhomboidal crystals; they are laid in clusters all through the milder months of the year and buried by the snail in the moist earth at the base of walls or the roots of shrubs and grasses; the young mollusks hatch out in from ten to twenty days, and attain maturity usually after their first hibernation, but the shells hatched in autumn do not attain full growth until towards the end of the summer following, and though potentially capable of surviving to an age of seven, eight or more years, it is probable that the bulk of the individuals die or are destroyed during their second or third hibernation.



FIG. 389.—Section of a follicle of the ovotestis showing the genesis of the germ cells, the ova on the walls and the sperm cells in the lumen of the cæcum (after Jeffrey Bell).

o. developing ova; s. developing spermatozoa or spermatoblasts.

Prof. A. Lang's experiments in inter-crossing the various varieties of *H. hortensis* showed that the 5-banded form breeds true, while the unbanded forms yielded unbanded progeny with a tendency to develop banding.

When unbanded and 5-banded forms are mated the progeny may be unbanded or nearly equally banded and unbanded. These variations in the results may be possibly due to the influence of the ancestral germ-plasma or even to a previous conjugation, as Lang affirms that after a single congress an individual has deposited fertile ova for three successive years.

The mating of *H. hortensis* with *H. nemoralis* was only successful in a single instance, and this was between a 5-banded *H. nemoralis* and an unbanded *H. hortensis*, the seven offspring of this union bearing shells which were intermediate in size between the parents, but of much greater altitude, and all were unbanded, with a lip the size and shape of *H. hortensis*, but darkly pigmented as in *H. nemoralis*, representing *H. hortensis* var. *fusco-labiata*, but no information is given of their gypsobela or "love-darts."

Habits and Habitats.—*Helix hortensis* is described as a somewhat indolent yet moderately sensitive animal, carrying its shell obliquely upright when crawling. It is less nocturnal in habit than its congener, though said by Nagel to be keenly skioptic or responsive to shade, and does not conceal itself so deeply and carefully during the day.

Though occasionally found occupying a common feeding-ground with *H. nemoralis*, it usually congregates in colonies unmixed with its ally, as it frequents moister and shadier localities and is more sensitive to drought than *H. nemoralis*, which seems to prefer drier and more open situations. A luxuriant damp and shady hedgerow is a favourite resort of *H. hortensis*, though it is also found in open woods, in gardens, in plantations and orchards, on old walls, and by road-sides. Like *H. nemoralis*, it seems most plentiful on limestone soils, but is by no means confined to them, as it may be found plentifully on sand-stone, trap, and other formations.

In Scotland, beyond the range and competition of *H. nemoralis*, the present species is very common on the pastures along the coast, especially among the sandhills, or in the shelter of the furze on the grassy slopes of the cliffs, localities which in England are usurped by *H. nemoralis*.

It is at times quite arboreal in its habits, especially in springtime and autumn, and has been known to ascend the beech and ash trees to a height of twenty or thirty feet, or climb to and cling persistently to the topmost twigs in a hedgerow, even during prolonged drought.

The heart's action fluctuates according to the temperature, but is also influenced by age and activity. At a temperature of 62° the heart of a specimen examined by Mr. Watson pulsated about forty-nine times per

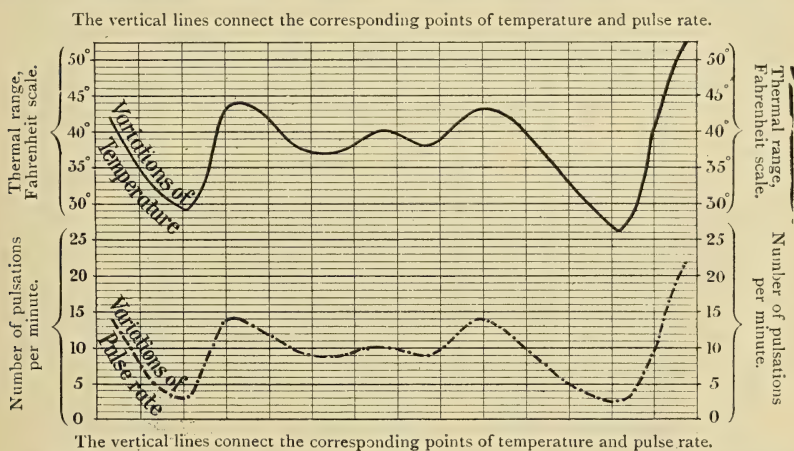


FIG. 390.—Diagram of the pulsations of the heart of *Helix hortensis*, illustrating the correlation of its activity with the changes of temperature.

minute, but the rapidity was increased to ninety-two per minute when placed upon the palm of the hand. The heart of an immature specimen at a temperature of 70° contracted ninety times per minute, while at a little below the freezing-point the pulsations are scarcely perceptible and not more than one or two per minute.

Like *Helix nemoralis*, the present species hibernates solitarily, in the crevices of walls and hollow places in trees, but very often among dead leaves or rubbish, burying its shell in the earth, spire downwards, and the mouth,

which is protected by the epiphragm, being level with the soil. It apparently withstands the cold better than its ally, as it usually retires later in the season, and reappears earlier, probably not becoming so inert and torpid, as it is more frequently noticed crawling about and feeding on the milder days of winter.

Helix hortensis is much more northern in geographical distribution and more montane in habit than *H. nemoralis*, and attains a higher altitude on the mountains, reaching to 6,000 feet near Andorra in the Pyrénées, and in Savoy, according to Dumont and Mortillet, ranging above the Vine zone, and reaching a height of nearly 5,000 feet; in these stations the epidermis is unusually thick and inclined to be deciduous, whereas when living on the lower ground it is thin, delicate, and persistent. In Derbyshire it has been observed by Mr. J. Wilfrid Jackson to reach a height of 1,800 feet in Cavedale.

Economic Uses.—It is an edible species in many parts of France, Belgium, and other countries of Central Europe. In common with *Helix pomatia* and other species it was formerly included in the *Materia Medica*, and constituted the basis of certain remedial preparations of reputed efficacy, and like *Helix nemoralis* has been used for personal ornamentation when strung together in the form of necklaces, etc.

Food.—Naturally it has been noted as feeding greedily upon nettles, and as being very fond of ragwort. Like *H. aspersa* and other species, it will lick off the coating of whiting and paste applied as a shade to the roofs of greenhouses, leaving thereon distinct traces of its pasturing.¹

Occasionally it will eat the leaves of the nut tree (*Corylus avellana*), and has been noticed feeding upon wild garlic (*Allium ursinum*) for which its ally has little relish, a food which may possibly be the source of the alliaceous odour so frequently noted as characterizing this species, and which is especially perceptible at the moment the animal is immersed in boiling water.

In Norway, it has been noted as frequenting orchards and feeding freely upon *Angelica sylvestris* and *Stachys sylvatica*.

In captivity, Dr. Gain offered this species 192 different kinds of food, and of these 138 were absolutely refused, an eloquent testimony to the efficacy of the defences of plants against their molluscan enemies.² Only one plant, the lettuce, was eagerly devoured, but thirty-six other foods were more or less freely eaten, and though those preferred were chiefly cultivated vegetables, from which the ranker and more acrid qualities had become eliminated, yet the list also included *Boletus edulis*, an edible fungus, *Scandix pecten-veneris* or Shepherd's Needle, and *Ranunculus arvensis* or Corn Crowfoot.

Though there was a general agreement between *Helix nemoralis* and *H. hortensis* in the selected foods, yet there were several instances of foods rejected by one of the species, being fed upon comparatively freely by the other: *Lepiota procera*, *Russula emetica* and *R. heterophylla*, which are fairly freely eaten by *H. hortensis*, are quite rejected by *H. nemoralis*, and it is remarkable that the common nettle (*Urtica dioica*) so frequently observed to be the food and shelter for the species of this group of shells, was in captivity equally refused by both species, as was also the Ragwort (*Senecio jacobæa*).

1 Monog. iii., p. 247 and figs. 2 Monog. i., pp. 286-289.

M. Rathay remarking on the habit of ascending the beech, ash, alder, and other trees, finds that this is done for the purpose of feeding upon the micro-alga, *Pleurococcus vulgaris*, clothing their bark, and that the wavy browsing tracks can be traced to a height of thirty feet or more from the ground; it is, however, probable that the *Pleurococcus* is not the only nourishment obtained, as it is passed through the body almost intact.

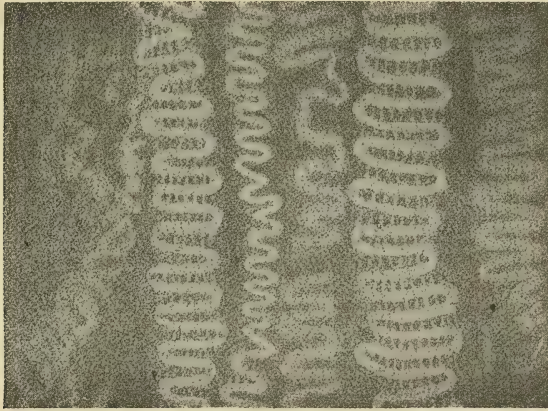


FIG. 391.—Feeding tracks of *H. hortensis*, and probably other species, showing the appearance produced by their browsing upon the *Pleurococcus* growing on the trunks of trees (after Rathay).

Parasites and Enemies.—*Helix hortensis* is preyed upon by the same enemies that are so destructive to the preceding species, suffering in common with it from the attacks of rats, mice, hedgehogs, rabbits, and other mammals.

It is also a favourite food of blackbirds, thrushes, and other birds, and its shell fragments are often very common around the “thrush stones,” striking relics of avian rapacity.

Drilus flavescens L., a beetle in which the male, though comparatively very small, is winged, while the female, which was regarded as a distinct species by Meilzinsky and named *Cochleoctonus vorax*, is large and apterous, being in reality only a slightly metamorphosed larva, and although very closely allied to the glow-worm, is not at all luminous. It is very destructive in its perfect and larval stages, destroying numbers of *H. hortensis*, *H. nemoralis*, etc., taking up its abode within the shell, while devouring the inhabitant.

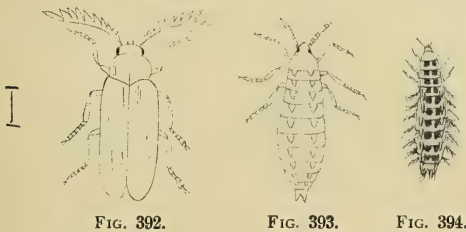


FIG. 392.

FIG. 393.

FIG. 394.

Drilus flavescens L., showing three of its phases of existence, in all of which it is destructive to the present and allied species.

FIG. 392.—The diminutive winged male, $\times 4$ (after Spry and Shuckard).

FIG. 393.—The large apterous female, slightly reduced (after Spry and Shuckard).

FIG. 394.—The active larval stage, slightly modified and reduced (after Westwood).

Mr. E. G. Bayford has graphically described the aspect and habits of the larva, a specimen of which he received on Sept. 5th, 1905, from Deal. It was scolopendroid in shape, and eighteen mill. in length and two mill.

in breadth, but capable of much greater extension; the head was of a reddish colour, the remaining segments except the last being yellowish above, each with a rectangular black or blackish mark, separated into two by the pale longitudinal mid-dorsal streak; the fifth to the twelfth segments each bore a pair of large and triangular creamy-white tubercles armed with long spiny brown setæ, a series of which also defend the spiracles. The underside was creamy-white, with two black streaks on each segment. The thirteenth segment is an ambulatory stump and bears a backwardly-directed bifid tubercle, set with long hairs on the upper side.

The larva was very active in its movements, and became very excited immediately on perceiving the presence of the *Helix*, which had been placed in the receptacle with it, mounting at once upon the shell, and bending its body round to insert the head and anterior segments into the shell at the base of the columella.

The snail on feeling the intrusion immediately withdrew into its shell, drawing in with its body still more of the larva. In its further attempts to squeeze out and get rid of its enemy, the snail repeatedly and quickly emerged from and retreated within its shell, but this was unavailing, as its tender body shrunk from contact with the spiny setæ of the larva, which also kept from the spiracles the slime thrown out by the snail, while at each retraction of the body the larva pressed further and still further within the shell, until the snail eventually gave up the struggle and became quiescent.

The larva then at once began devouring its victim, whose juices could be distinctly seen passing down its gullet. In about four days the snail was almost wholly consumed, the body of the larva having become distended to an enormous extent, and, except for a slight occasional contraction of the segments, it remained motionless until May 19th of the following year, when it passed quickly through the pupa state, emerging as a fine female beetle on the following day.

The *Philodromus limacum*¹ is also common on this species, and would appear to be very hardy and indifferent to cold, as they have been observed in winter imprisoned behind the epiphragm of a hibernating animal, running about quite actively within the restricted space.

The *Distomum caudatum* of Loos (referred to on p. 282) is said by Prof. Blochmann to pass its sexually mature stage in the intestinal canal of the hedgehog, and to have *Helix hortensis* for its intermediate host, gaining access to the snail in its early and active larval stage, and lodging within the kidney during the cercarian period, completing its development within the hedgehog when it has devoured the snail.

Conchophthirius steenstrupii Stein, a Protozoan, belonging to the *Paramæciidæ*, is also recorded as a minute ecto-parasite on the body of the present and other species, feeding upon the mucus or slime. It is of a depressed broadly-oval shape, with the widely infundibular fossa placed near the anterior end, the body being clothed with long and delicate cilia; and the contractile vesicle spherical in shape and subcentral in position.

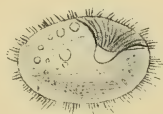


FIG. 395.



FIG. 396.

Conchophthirius steenstrupii Stein, showing the dorsal and lateral aspects, $\times 150$ (after Quennerstedt).
FIG. 395—Dorsal aspect. FIG. 396—Lateral aspect.

Geological Distribution.—Though undoubtedly a more ancient and in some respects a more simply organized form than *H. nemoralis*, it has not yet been observed from deposits earlier than those of Pleistocene age, while *H. nemoralis* has been recorded from those of the Miocene period. Possibly, however, some or many of the records may be more properly referable to the present species, which has been for so long confused with and so often recorded as *H. nemoralis*.

PLEISTOCENE.—In South Devon, it was found in Happaway Cavern, near Torquay, by Mr. W. Pengelly.

In West Kent, it has been found by Mr. J. Lewis Abbott in the Ightham fissure near Wrotham, all the specimens being of medium size, and 12345 and 00000 being about equally numerous; there were also a number of shells curiously intermediate between the present species and *H. nemoralis*.

In South Essex, it is recorded by Prof. Morris and others from the mammalian deposits at Grays and Uphall brickfield, Ilford. In North Essex, it is known from similar lacustrine beds at Copford and Clacton.

In East Suffolk, Prof. Morris also discovered this species with extinct mammalian remains at Stutton.

In Mid Lancashire, it has been recently discovered in the lower deposit of Cave-earth in the "Dog Holes" Cavern, Warton Crag, near Carnforth, by Mr. J. Wilfrid Jackson.

In Germany, it is recorded by Prof. Sandberger from beds of Mid-Pleistocene age at Cannstadt, Burgtonna, and Muhlhausen, Thuringia; in the tufa of Canth, Silesia, and in löess at Robschütz, near Dresden, Saxony. He also records it from tufaceous beds of Upper Pleistocene age at Burgtonna, Muhlhausen, and Canth; and Herr Clessin has discovered it in Bavaria in tufa deposits of Láaber Valley, nr. Regensburg, and at Pürklgt.

In France, Prof. Sandberger also reports it from the grey-clays of the Lower Pleistocene period at Boisse, Savoy, and from beds of Mid-Pleistocene age at Celle, Seine-et-Marne. Comm. Caziot reports it from the deposits at Villefranche-sur-Mer, Alpes Maritimes.

In Switzerland, it is also known from the Mid-Pleistocene beds in the canton of St. Gall.

In the Nearctic region, it is recorded from the glacial Pleistocene clays of the Champlain epoch at Portland on the coast of Maine by Dr. Dall.

HOLOCENE.—In West Cornwall, it is recorded by Kennard and Warren from the early Holocene loamy bed and also as buried beneath the later æolian or "blown" sands of Towan Head.

In North Wilts., it was found by Mr. H. St. George Gray in deposits of the Bronze age at Avebury, as well as in the more superficial layers.

In Dorset, it is recorded from the tufa beds at Blashenwell near Corfe by Mr. Clement Reid; and two specimens were collected by Mr. H. St. George Gray during the excavations of the Roman Amphitheatre at Dorchester, now known as "Maumbury Rings."

In the Isle of Wight, it is recorded by Prof. Forbes from the lacustrine beds at Totlands Bay; and by Kennard and Warren from tufa near top of cliff, south-west of Widdick Chine.

In West Sussex, Mr. Alfred Bell enumerates it amongst the fossils found in the "mud deposit" at Selsea.

In West Kent, it was found by Mr. Kennard at the base of a tumulus in Stanley's Quarry, Ightham.

In Surrey, the Rev. R. Ashington Bullen found specimens at a depth of from three to four feet in the Horseshoe Pit, Colley Hill, Reigate.

In South Essex, Mr. B. B. Woodward has recorded the finding of specimens showing the formulæ 12345, 1(23)45, 1(2345), and 00000 in the shell-marl disclosed by the excavations for the reservoir of the East London Waterworks at Walthamstow; Mr. R. Miller Christy has noted the species from the shell-marl, black-earth, and peat-layers of the river Cann, about Chignal St. James; and Mr. J. French in the alluvium at Felstead.

In Hertfordshire, it was discovered by Mr. J. Hopkinson in the alluvial marl deposit of the old bed of the river Colne exposed by the excavations for the gas works at Watford.

In Middlesex, Mr. J. E. Cooper reports it from the shell-bed and from the superimposed brick-earth disclosed by the excavations near the gas works, Staines.

In East Gloucester, it is recorded by Mr. Kennard from the dirt band of probably old soil, and the surface "tip" of the quarry at Cleeve Hill.

In Hereford, Boycott and Bowell report its presence in a fluviatile deposit near Ledbury Church, on the authority of Mr. Ballard.

In Stafford, it is reported from the alluvium of the Cocker Beck, a tributary of the Trent, by Mr. Clement Reid.

In North Lincoln, Mr. J. F. Musham reports it from a deposit at Greetwell.

In Mid West Yorkshire, it is recorded from the fluviatile deposits of the River Ribble at Great Mitton, by Mr. J. Wilfrid Jackson.

In South Northumberland, it is recorded by Mr. A. Meek as found between two concrete floors exposed during the excavations of the Roman city of Corstopitum.

In Cheviotland, it is recorded by Mr. G. Johnston as found in 1854 in a gravel-bed on Holy Island.

In Ireland, the Rev. A. H. Delap reports its existence in a marl deposit near Clonmel in South Tipperary.

In Germany, Prof. Cockerell informs me that specimens exist in the Basle Museum from the post-glacial diluvium of Kiffis, Upper Alsace.

In Belgium, it is recorded by M. le Comte from Hainault in the alluvium of the Dendre, Denderleuw; from that of the Sambre at Landelies and Aulne by Van den Broeck. M. Roffiaen notes it from the deposits near Waremmé, Liège, and at Bouillon, Luxemburg; while M. Grégoire records it as common in the "Tourbe," at Uccle lez-Bruxelles, Brabant.

In Sweden, Herr Hägg records it from a black sand of boreal age beneath the Neolithic submarine peat deposit at Ystad, Malmöhus; and Herren Hägg and Odhner from Skåne, Jemtland, Westergötland, Östergötland, Upland, the Island of Gothland, and Narke, in a series of beds which have been distinguished as Boreal, Atlantic, sub-Boreal and sub-Atlantic, and deposited during the gradual amelioration of the climate, when the greatest severity of the Glacial period had passed.

In Denmark, Dr. Johansen has recorded it from Jutland, in the ancient Neolithic "kitchen-middens" at Meilgaard and Dingen, as well as from the marl-beds at Gytje. On Zealand it occurs in the old Neolithic deposit by the Free Harbour, Copenhagen; in those near Oxnebjerg in the Island of Funen; and in the marl-beds of Bodilsker, Bornholm.

In the Nearctic region, it is recorded by Dr. Dall as found in the pre-Columbian and pre-historic shell heaps or "kitchen-middens" of the extreme north-east of the United States; and Rev. G. D. Reid discovered it in the shell-heaps on the Island of Martha's Vineyard.

Variation.—The variation of *H. hortensis* is chiefly in the colour or shade of the general tint of the shell, which may vary from almost pure white to a very dark greenish-black; the size, substance, and shape of the shell are also subject to certain differences, while variations in the number and arrangement of the spiral bands are very few, the great bulk of the specimens possessing all the five normal bands or being entirely bandless.

Like its allies, the ground colour of the shell of *Helix hortensis* is chiefly due to the periostracum or epidermis, while the spiral zonulation or banding is seated in the calcareous layer beneath, but unlike *H. nemoralis*, the broken-banded variation, known as var. *punctella*, so common under certain conditions in that species, is in *H. hortensis* very rarely found.

Herr Clessin has remarked that the most brightly coloured shells are most frequent in open-wooded grounds, while the duller specimens with delicate and somewhat deciduous epidermis are met with about old ruins and on isolated shrubs, chiefly of *Prunus spinosa*, and the dark-coloured varieties are almost restricted to dense deciduous woods with a thick carpet of vegetable débris.

The umbilical region of the shell is sometimes noticeably darker in this as in the preceding species, and Dr. J. W. Williams suggested that this darkening was due to discolouration caused by the constant damp to which the base of the shell is exposed, but it may possibly be atavic in character, comparable to the whitish opacity so conspicuous beneath the shells of certain of the *Hyalinæ*, as previously suggested.

In America, according to Dr. Dall, the more brightly-coloured types with sharply-defined bands form an insignificant proportion, while the shells on the whole are smaller than the average of European shells.

The colour of the lip is very variable, and though usually white, may be of almost any intermediate shade between pure white and deep black, but it is noteworthy and a probable testimony of the more recent acquirement of the pigmented lip that the darker shades fade very rapidly in this species, while in *Helix nemoralis* the normal dark lip is practically permanent, implying a much longer possession of the character.¹

There is little doubt that food and environment do affect and modify the colouration of shells, and of this further confirmation is afforded by the experience of Capt. Farrer, who collected at York a number of half-grown specimens of the dark variety *olivacea*, which he reared to maturity at Bassenthwaite, feeding the animals on cabbage leaves and turnip; and it is remarkable that the shell growth made under the altered conditions was abruptly changed in colour from a deep olive-brown to white.

The protective resemblance of the shells of this species to other animate or inanimate objects has not been much remarked upon, except by Dr. Dall, who has suggested the possibility that the striped ornamentation of the *Pentatentia* would probably aid in their concealment amongst the lights and shadows of the vegetation, and lead one to attribute the genesis of these markings to similar causes to those that led to the development of the striped markings of the tiger; and by Captain W. J. Farrer, who has pointed out the extraordinary resemblance of the var. *lutea* to the closed or partially-closed flowers of the Lesser Celandine (*Ranunculus ficaria*), upon which plant they are found in numbers during April and May, affirming that it is difficult to distinguish the shell from the flowers, so much are they alike in form and colour.

In Band Variation, *Helix hortensis* differs markedly from *H. nemoralis* in the comparative paucity of its mutations, for whereas in *H. nemoralis* all the possible eighty-nine band variations are actually known to exist, in *H. hortensis* no less than twenty-eight possible arrangements have never yet been observed or reported, and their discovery awaits the energetic observer.

Although five is the normal number of bands on the shell, yet extra bands are occasionally present, due to a development of additional pigment cells on the mantle margin of the animal, or to a splitting-up of the cellules normally present, evidenced by the separation of each fascia into two or more slender lines or bandlets. This increase in the zonulation may also arise from the concentration of the colouring matter at the outer edges of the zones, thus apparently doubling their number.

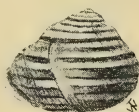


FIG. 397.—*Helix hortensis* (Folkestone, Mrs. Fitzgerald), showing the concentration of pigment at the margins of the spiral banding of the shell.

The band formulæ more especially characteristic of *Helix hortensis* are, according to Lang, 10305 and 02340, while in *H. nemoralis* he regards 00345, 00(345), 003(45), and 00045 as the most distinctive banding.

The **five-banded** variations are sixteen in number, and all are on record for this country and abroad.

1 2 3 4 5	(1 2 3) 4 5	(12)(3 4 5)	1 (2 3) 4 5
(12 3 4 5)	(123)(4 5)	(12)(3 4) 5	1(23)(4 5)
(123 4) 5	1 2(3 4 5)	(12)3(4 5)	1 2(3 4) 5
1(23 4 5)	(1 2) 3 4 5	1 (2 3 4) 5	1 2 3(4 5)

The most abundant variation is the formula 12345, the *quinquevittata* of Moquin-Tandon, which is considered as the type and is usually the most plentiful wherever the species is found, but in New England, on the contrary, it is according to Mr. G. H. Clapp the most uncommon form.

Somewhat less common are (123)(45) and (12345), which are also known from Germany, France, Sweden, and North America.

The formulæ 123(45), 1(23)45, (12)3(45), (12)345, (123)45 and 1(23)(45) are still more uncommon, but all are reported from Germany, and many of them from other countries in Europe or from North America.

The formulæ (1234)5, 1(234)5, and 1(2345) are of much less frequent occurrence, while 12(345) (12)(345), (12)(34)5, and 12(34)5 are by far the rarest of the section, but yet occur in our own and other countries.

The **four-banded** section embraces twenty-eight different forms, and includes, as in *Helix nemoralis*, a larger proportion of rare or unknown band variations than any other group.

1 2 3 4 0	1 2(3 4) 0	1 2 0(4 5)	0(2 3 4 5)
(1 2 3 4) 0	1 2 3 0 5	(12)0(4 5)	0(2 3 4) 5
(1 2 3) 4 0	(1 2 3) 0 5	1 0 3 4 5	0(23)(4 5)
(12)(3 4) 0	(1 2) 3 0 5	1 0(3 4 5)	0(2 3) 4 5
(1 2) 3 4 0	1(2 3) 0 5	1 0(3 4) 5	0 2(3 4 5)
1(2 3 4) 0	1 2 0 4 5	1 0 3(4 5)	0 2(3 4) 5
1(2 3) 4 0	(1 2) 0 4 5	0 2 3 4 5	0 2 3(4 5)

The very commonest varieties in the British Isles are 10345 and 12045, which are found in Germany, France, Scandinavia, Switzerland, and North America, 12045 being also recorded from Finland.

The formulæ 12305, 103(45), 023(45) are rare in the British Isles, but are also German; 120(45) is also very scarce in this country, though known to exist in Germany and North America; and 12340, though almost unique in English records, is cited from Germany, France, and North America; while 02345, a much commoner form in this country, is only on record from Germany, France, and Switzerland.

As far as at present known, (12)0(45), 0(23)(45), and (12)045 are exclusively British, the latter having only been met with by Mr. C. H. Morris near Lewes, as the early record by Prof. Cockerell probably referred to the same specimens, while 0(2345), (12)305, and 1(23)05 are only reported from Germany and have never been met with in the British Isles.

No less than fourteen formulæ—(1234)0, (123)40, (12)(34)0, (12)340, 1(234)0, 1(23)40, 12(34)0, (123)05, 10(345), 10(34)5, 0(234)5, 0(23)45, 02(345), and 02(34)5—are as yet totally unknown to science.

The **three-banded** section contains many rare or unknown band formulæ, being scarcely inferior in this respect to the tetrafasciate group.

There are twenty-five varieties :

1 2 3 0 0	(12)0 0 5	0(2 3 4)0	0 2 3 0 5
(1 2 3)0 0	1 0 3 0 5	0(2 3)4 0	0(2 3)0 5
(1 2)3 0 0	1 0 3 4 0	0 2(3 4)0	0 2 0 4 5
1(2 3)0 0	1 0(3 4)0	0 0 3 4 5	0 2 0(4 5)
1 2 0 4 0	1 0 0 4 5	0 0(3 4)5	
(1 2)0 4 0	1 0 0(4 5)	0 0(3 4)5	
1 2 0 0 5	0 2 3 4 0	0 0 3(4 5)	

The commonest of the section in this country are 10045 and 00345, which are also found in Germany and France, the latter variety being on record for Switzerland and Livland also; the formula 10305, though not so common in this country, has been quoted from Germany, France, Belgium, Switzerland, and Norway; 12300, though scarce in England, is known from Germany, France, and North America; 003(45) is found in Germany and France, but is only reported from this country by Mr. C. D. Heginbotham and Mr. Swanton; 100(45) is quite scarce, being reported only by Mr. J. F. Musham and Mr. Swanton; 02340 and 12040 are also very rare in the British Isles, the latter being only reported by the Rev. W. A. Shaw, but all are on record by Dr. von Martens for Germany.

Dr. von Martens also quotes as German 12005 and 10340, and Picard cites (12)300 from the Somme, but these have not as yet been found in the British Isles or in other countries.

The formulæ 1(23)00, (12)040, and 02045 are according to present knowledge restricted to the British Isles, and have never been reported from any other country; while (123)00, (12)005, 10(34)0, 0(234)0, 02(34)0, 00(345), 00(34)5, 02305, 0(23)05, and 020(45) are as yet quite unknown.

The **two-banded** group contains fourteen variations:

1 2 0 0 0	0 0 3 4 0	1 0 3 0 0	0 2 0 0 5
(1 2)0 0 0	0 0(3 4)0	1 0 0 4 0	0 0 3 0 5
0 2 3 0 0	0 0 0 4 5	1 0 0 0 5	
0(2 3)0 0	0 0 0(4 5)	0 2 0 4 0	

The commonest forms in this country are 10005, 00045, 00305, and 00340, which are also found in Germany, France, and Switzerland, the latter variety in North America also.

The variation 10300 is recorded from Germany and France, and 000(45) from Germany by Meyer, but both forms are quite rare in the British Isles, and in North America.

The formula 12000 has only been found in this country by Mr. R. Cairns, and 02300 by Mr. A. Belt and Mr. C. E. Wright, but both are known on the continent, from Germany only.

The formula 0(23)00 is recorded by Cardot for the Ardennes, and by von Martens for Germany, and is the only representative of this section recorded from the continent which has not yet been discovered in this country; while inversely 10040, found by Mr. C. E. Wright at Racton, Hampshire, has not yet been found abroad; while (12)000, 02040, 02005, and 00(34)0 are as yet unrecorded or unknown.

The **one-banded** forms are only five in number, and all are known to occur in the British Isles and abroad:

1 0 0 0 0	0 0 3 0 0	0 0 0 0 5
0 2 0 0 0	0 0 0 4 0	

Of these, the formula 00300 is by far the commonest variation in this country, and is also found in and recorded from Germany, Switzerland, France, and the United States.

The formulæ 00005, 00040, and 10000 are quite rare in the British Isles, and 10000 is only reported from Germany by Schmidt and Sikes; 00005 from Germany by von Martens; from France as var. *morletia* by Locard, and as var. *barraudia* by Moquin-Tandon; and 00040 from France as var. *fischeria* by Moquin-Tandon, from Germany by von Martens, and from the United States by Mr. G. H. Clapp; while 02000 is only reported from this country by Rev. W. A. Shaw, though also found by Dr. Schmidt in Germany.

The **bandless** or unicolorous variation is much commoner in the present species than in *Helix nemoralis*, and like the typical five-banded form is coincident in its range with the species itself, and is one of the most plentiful of the many forms this species assumes.

VARIATIONS IN FORM OF SHELL.

Var. *trochoidea* Clessin.

Helix hortensis var. *trochoidea* Nachrichtsbl. Deutsch. Mal. Gesell., 1871, p. 127.

SHELL with a much more elevated spire, typically 19 mill. in diameter and 17 mill. in altitude.

It is the var. *trochoides* of Prof. de l'Hôpital.

ENGLAND AND WALES.

Devon N.—Sub-var. *conica*, Ilfracombe (Beeston and Wright, J. of C., xi., p. 75).

Dorset—Bridport, Sept. 1895, C. E. Wright.

Northampton—Middleton, Aug. 1898; Oundle, Sept. 1905; and Kettering, June 1893, C. E. Wright.

Leicester & Rutland—Great Easton! and Liddington, May 1899, C. E. Wright.

Worcester—Dunley, Stourport, Dr. J. W. Williams.

Pembroke—Gumfreston, July 1905, C. E. Wright.

Lancashire S.—Simonstone, R. Wigglesworth.

York S.W.—Kexborough, July 1906! W. E. Brady.

York Mid W.—Near York, R. Miller Christy.

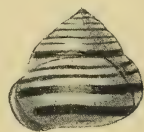


FIG. 398.—*H. hortensis* var. *trochoidea* Clessin.

Great Easton, Leicestershire (Mr. C. E. Wright).

CONTINENTAL DISTRIBUTION.

Germany—Recorded by S. Clessin with typical shells from railway embankments, Dinkelscherben, Bavaria.

France—Recorded from the Somme by Picard; and from Calvados by de l'Hôpital.

Var. *depressa* Baudon.*Helix hortensis* var. *depressa* Baudon, Journ. de Conch., 1884, p. 236.

SHELL very depressed and flat.

ENGLAND.

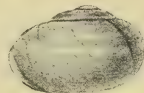
Devon N.—Ilfracombe (Beeston and Wright, l.c.).

Northampton — Almost like *Helix itala* in form,

Northampton road, Kettering, Sep. 1907 ! C. E. Wright.

Pembroke—Tenby, July 1905 ! Rev. H. Milnes.

Lancashire S.—Altham, June 1890 ! R. Wigglesworth.

FIG. 399. — *H. hortensis* var. *depressa* Baudon.

Kettering (Mr. C. E. Wright).

CONTINENTAL DISTRIBUTION.

France—Recorded by Picard for the Somme ; by Baudon from Mouy, Oise ; and by Bouillet from Mont Dore, Puy de Dôme.

Belgium—A planorboid specimen found at Dinant, Namur, by Van den Broeck.

Var. *perforata* Westerlund.*Helix hortensis* var. *perforata* Westerlund, Exp. Crit., 1871, p. 40.*Helix hortensis* var. *umbilicata* Crowther, Sci. Goss., 1883, p. 6.

SHELL with a more or less open umbilicus.

The var. *perforata* does not possess the heavy umbilical callus, and therefore shows an open umbilicus.

ENGLAND.

York Mid W.—Tadcaster (Crowther, op. cit.).

CONTINENTAL DISTRIBUTION.

Sweden—Among junipers near Wanlingbo Church, Island of Gothland (Westerlund, l.c.). It is described as distinctly umbilicate, and the shell as having the five normal bands.

Var. *subcarinata* Picard.*Helix hortensis* var. *subcarinata* Picard, Moll. Somme, 1810, p. 216.

SHELL subcarinate, the angulation being most perceptible towards the aperture.

CONTINENTAL DISTRIBUTION.

France—Described from specimens found in the department of the Somme.

VARIATIONS IN SUBSTANCE OF SHELL.

Var. *crassa* Cockerell.*Helix hortensis* var. *crassa* Cockerell, Nat. World, Jan. 1885, p. 1.*Helix hortensis* var. *crassa* Westerlund, Faun. Binnenconch., ii., 1889.

SHELL thicker and more ponderous.

ENGLAND.

Kent W.—Near Lamberhurst, Aug. 1884 (T. D. A. Cockerell, l.c.).

CONTINENTAL DISTRIBUTION.

Sweden—Benestad, Skane (Westerlund, Syn. Moll. Extram., 1897, p. 58).

Var. *ludoviciana* Moquin-Tandon.*Helix hortensis* var. *ludoviciana* Moquin-Tandon, Hist. Moll. France, 1855, p. 166.*Helix hortensis* var. *tenuis* Baudon, Journ. de Conch., 1884, p. 237.

SHELL thinner and more fragile.

The var. *ludoviciana* is described as very small and transparent.The sub-var. *tenuis* is pellucid and unicolorous or banded.

ENGLAND.

Devon N.—Ilfracombe, common, Aug. 1903 (Beeston and Wright, l.c.).

Cornwall W.—Truro, 1888, J. H. James.

Devon S.—Culverhole Point and Topsham, Aug. 1892, Lionel E. Adams.

Hants. S.—Christchurch, formula 00300, July 1897, C. E. Wright.

Somerset N.—Sub-var. *tenuis*, Bratton St. Maur, E. W. Swanton.

Sussex W.—Lavant, Oct. 1901, C. E. Wright.

Essex N.—Dovercourt, Sept. 1909 ! C. E. Wright.

Middlesex—Boston road, Hanwell, Sept. 1883 ! Mrs. Skilton.

Norfolk E.—Yelverton, 1891 ! Rev. S. Spencer Pearce.

- Stafford**—Stafford, 00000, May 1890! L. E. Adams. Acton, Oct. 1898, C. E. Wright.
Northampton—Middleton, 00300, Aug. 1898, C. E. Wright. Haselbeeche, 00345, April 1904, Rev. W. A. Shaw.
Gloucester E.—Birdlip! E. J. Elliott.
Rutland—Liddington, May 1899, C. E. Wright.
Lincoln N.—Spilsby, Aug. 1904, Rev. E. A. Woodruffe-Peacock.
Cumberland—Bassenthwaite, W. J. Farrer. The Scaur, Mrs. G. B. Longstaad.

FOREIGN DISTRIBUTION.

- Germany**—Recorded from Alsace by Meyer; and from Bavaria by Westerlund.
France—A reddish sub-variety is recorded from Auvergne by Moquin-Tandon. The sub-var. *tenuis* is recorded by Dr. Bandon as rare in the Oise, and was found by Dr. Scharff at Bordeaux, Gironde.
Russia—South Finland (Westerlund, l.c.).
Norway—Jarlsberg and Lillesand, Miss Esmark.
Sweden—Ronneby and Oviken (Westerlund, Syn. Moll. Extram., 1897, p. 57).
Denmark—Frederiksdal and Linaa Westerskov (Westerlund, op. cit.).
Iceland—In the south-east of the island (Westerlund, op. cit.).
Newfoundland—Islands of St. Pierre and Miquelon! A. Shaw.

VARIATIONS IN SIZE OF SHELL.

Var. *major* Moquin-Tandon.

Helix hortensis var. *major* Moquin-Tandon, Hist. Moll. France, 185 vol. ii., p. 163.

SHELL noticeably larger than the type, attaining a diameter of 25 mill. or more.

In Savoy, the var. *major* frequents the plains and valley bottoms, differing in this from the var. *minor*, which is found on the mountain sides.

Dr. Gassies remarks that he has found in the Pyrénées Orientales specimens of var. *hortensis* one-third larger than the largest *H. nemoralis*; it is, however, probable that he confused the albolabiate form of *H. nemoralis*, which is very common and large in the Pyrenean Mountains, with the true *H. hortensis*, more especially as he did not regard the two forms as distinct, and would be probably guided chiefly by the colour of the peristome.

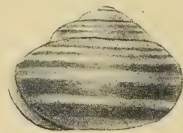


FIG. 400.—*H. hortensis* var. *major* Moq.
Hampshire (Mr. C. E. Wright)

ENGLAND.

- Somerset N.**—Bratton St. Maur near Bruton, E. W. Swanton.
Isle of Wight—Ventnor and Yarmouth, 24.5 mill. in diameter, C. Ashford.
Sussex W.—Cocking! C. E. Wright.
York Mid W.—York, R. M. Christy.

CONTINENTAL DISTRIBUTION

- Germany**—Recorded from Alsace by Meyer.
France—Moquin-Tandon records very large shells from Grenoble, Isère; Toulouse and Luchon, Haute Garonne; Foix, Ariège; Eaux Bonnes, Basses Pyrénées; and from the valley of Carol and Esquierry in the Pyrénées. M. Pascal records var. *major* from the quarries by the forest at l'Isle Adam, Seine-et-Oise; Bouillet from Auvergne; Dumont and Mortillet from Savoy; and Dr. Grateloup a var. *gigantea* from Ariège.
Switzerland—Specimens of large size recorded from Kussnacht, Schwyz, and Meiringen, Berne, by M. Roffiaen.

Var. *minor* Moquin-Tandon.

Helix hortensis var. *minor* Moquin-Tandon, Hist. Moll. France, 1855, p. 168.
Helix hortensis var. *minima* Colbeau, Ann. Soc. Mal. Belg., 1865, i., p. 33.

SHELL smaller than type.

The var. *minor* is described as small, the dimension being given as 15 mill. in diameter.

The sub-var. *minima* is described as having a major diameter of about 15 mill., and a minor diameter of about 13 mill.

The var. *minor* sub-var. *montana* of Charpentier, from Bex, Switzerland, as figured by that author, has been generally considered to be a form of *H. hortensis*, but is probably not referable to this variety, and would really seem by its shape more related to the albolabiate form of *H. nemoralis*.

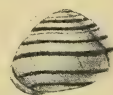


FIG. 401.—*H. hortensis* var. *minor* Moq.
Weekly, Northamptonshire
(Mr. C. E. Wright).

The var. *minor* of Cockerell (Nat. World, 1885, p. 145) is described as 18 mill. in diameter and 15 mill. in altitude.

Dumont and Mortillet note that in Savoy this variety is found on the mountains or the upper part of the valleys; and Mr. J. Hawkins, of York, has recorded that when living on Vetch (*Vicia sativa*) the shells of this species are almost uniformly dwarfed or stunted in size.

ENGLAND.

- Devon S.—Common, Alphington, E. D. Marquand. Teignmouth, L. St. G. Byne.
 Devon N.—Ilfracombe (Beeston and Wright, l.c.).
 Somerset N.—Bath, June 1886, Miss Fairbrass. Blagdon, Aug. 1883, Miss Hele.
 Bratton St. Maur, E. W. Swanton. Bruton, Sept. 1910! C. D. Heginbotham.
 Hants. S.—Christchurch, 1885! C. Ashford.
 Kent E.—Folkestone, 1883, Mrs. Fitzgerald.
 Bedford—Amphill, 1886, C. Ashford.
 Northampton—Swarming in hedges, Warkton, May 1895; Weekly, Oct. 1907! stone quarries, Blisworth, June 1895; Luddington, Sept. 1898; Claphorne, June 1909; railway bank, Kettering; and Middleton, Sept. 1897, C. E. Wright.
 Gloucester E.—Gloucester, July 1885! Rev. H. Milnes.
 Notts.—Thrumpton, 1879, C. T. Musson. Colwick, B. Sturges Dodd.
 Derby—Matlock, J. A. Howe. Cavedale, July 1901, J. Wilfrid Jackson.
 York S.W.—Newton and Oulton, 1883, J. Wilcock.
 York Mid W.—Knaresborough, 1881, Rev. W. C. Hey. Boston Spa, 1884, J. Emmet. St. Mary's, York, July 1879! W. Denison Roebuck.
 York N.W.—Gunnorside, July 1884! W. Denison Roebuck. Croft near Darlington, June 1893! C. Oldham.
 Cheviotland—Alnmouth, 1889, Rev. Dr. McMurtrie.
 Cumberland—Bassenthwaite, W. J. Farrer.

SCOTLAND.

- Perth Mid—Mr. H. Coates records that this form is very local at Balgowan.
 Perth N.—Glen Tilt, alt. 1,600 ft., and Blair Atholl! Dr. Buchanan White.
 Kincardine—Stonehaven! W. Turner.
 Ross W.—Recorded by Dr. J. G. Jeffreys from Loch Carron.
 Sutherland W.—Kyle of Tongue, July 1883! W. Baillie.
 Shetland Isles—Recorded by Dr. Jeffreys on the authority of Mr. Barlee.

FOREIGN DISTRIBUTION.

- Germany—Georgenthal, Thuringia, May 1904! F. H. Sikes; Ems, Nassau! R. F. Scharff; and recorded by Meyer from Alsace.
 France—Recorded from Cussac, Haute Loire, by Pascal; from Auvergne by Bouillet; by Dumont and Mortillet from Savoy; and by Moquin-Tandon from Toulouse, Haute Garonne; Sorèze, Tarn; and Pyrénées Orientales. Found by Mr. W. Eagle Clarke at Ax and Tarascon, Ariège, in May 1889!
 Belgium—Sub-var. *minima*, rather common at Spa, on the road to Barisart, Liège, J. Colbeau; and also found at Hastières-Lavaux, Namur, Mr. A. E. Craven.
 Spain—Reported by Mr. W. Eagle Clarke from the republic of Andorra.
 Austro-Hungary—Recorded for churchyard walls near Böhmisch-Leipa and near Turnau, Bohemia, by Slavik.
 Norway—Jarlsberg, Christiania, Lier, Modum, and Fredrikshald in Christiania Stift, and Lillesand in Christiansand Stift, Miss Esmark.
 Sweden—Lutterhorn, Farö Isle near Gothland (Westerlund, l.c.).
 United States—Prof. Cockerell referred to this variety a specimen 17 mill. in diameter found by Mr. J. H. Thomson at Gay Head, Martha's Vineyard, Mass.; and Mr. G. H. Clapp records a somewhat smaller shell from Rockport. It is also reported from other localities in Massachusetts and from Maine.

VARIATIONS IN COLOUR OF SHELL.

This section, which includes all the different ground colours to which the species is liable, has been distinguished, when devoid of banding, as var. *concolor* by Picard, as var. *unicolor* by Moquin-Tandon, and as var. *infasciata* by Puton.

Var. *alba* Picard.

- Helix hortensis* var. *alba* Picard, Mo'l. Sonme, 1840, p. 215.
Helix hortensis var. *albina* Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 168.
Helix hortensis var. *grisea* Esmark, Journ. of Conch., 1886, p. 109.
Helix hortensis var. *isabellina* Esmark, op. cit.
Helix hortensis var. *alba unicolor* Boycott and Bowell, Contr. Fauna Heref., 1899, p. 63.

SHELL white, sometimes slightly greenish.

The sub-var. *albina* Moq. is described as white or whitish.

The sub-var. *subalbida* Locard is described by Cockerell as very pale and almost white.

The sub-var. *grisea* Esmark, being a descriptive name, does not appear to have been formally described; it probably is intended to indicate a sullied whitish form.

The sub-var. *isabellina* is also a descriptive term, expressive of a dirty cream colour or the hue of very soiled linen.

The *H. hortensis* and *H. nemoralis* obtained from ash trees near York are, according to Mr. J. Hawkins, usually pale in colour.

Herr Dietz observes that specimens of the var. *albina* are more common in wet years; but Messrs. Boycott and Bowell point out that, on the principle that extremes meet, a succession of dry seasons apparently has a similar effect, as during the unusually dry summer of 1896, which was preceded by several seasons of similar character, a very marked tendency towards albinism was shown by this species around Hereford.

The unicolorous form is the var. *alba unicolor* of Boycott and Bowell (op. cit.); and the fasciate form is the var. *alba fasciata* of the same authors. The formula 00305 has been distinguished as var. *grateloupia* by Moquin-Tandon.

ENGLAND.

- Cornwall** W.—Sub-var. *subalbida*, Truro ! J. H. James.
Devon N.—Common, Ilfracombe, 103(45) and 1(23)45 (Beeston and Wright, l.c.).
Devon S.—Dawlish, 1909, C. E. Wright.
Somerset N.—Bitton near Bath ! common in hedgerows, Cheddar and Portishead, 1883, Miss Hele. Not common, Bratton St. Maur near Bruton, E. W. Swanton.
Wilts N.—Var. *alba* and sub-var. *subalbida*, Swindon, July 1886, T. D. A. Cockerell.
Dorset—Charminster, 1889, T. F. Burrows. Bridport, Sept. 1895, C. E. Wright.
Hants. S.—Hayling, June 1896; Christchurch, July 1897; Pockstone, Oct. 1901; and Ringwood, Aug. 1902, C. E. Wright.
Sussex W.—Worthing, 1886 ! B. M. Oakeshott.
Kent E.—Maidstone, H. Elgar. Dover, Apr. 1896, Rev. J. W. Horsley. Canterbury, C. E. Wright.
Berks.—Maidenhead, July 1884 ! L. E. Adams.
Suffolk W.—Sudbury, E. Ransom.
Norfolk E.—Alpington, Rockland, and Yelverton, Rev. S. Spencer Pearce. Catton, Aug. 1891 ! Brundall, Old Lakenham, etc., A. Mayfield.
Norfolk W.—King's Lynn, T. Petch.
Hunts.—Great Raveley, Oct. 1909; and Buckden, 00300, Sep. 1909, C. E. Wright.
Northampton—Sub-var. *subalbida*, Blisworth, 1885 ! W. D. Crick.
Gloucester W.—Stainton, July 1891 ! W. Whitwell.
Hereford—Vars. *alba unicolor* and *alba fasciata* are cited from near Hereford by Boycott and Bowell (op. cit.).
Worcester—Dunley and Wilden, June 1888, J. W. Williams.
Warwick—Warwick ! W. Nelson.
Cardigan—Sub-var. *subalbida*, Borth, Aug. 1907 ! A. H. Jowett Murray.
Rutland—Liddington, May 1899, C. E. Wright.
Lincoln S.—Crowland, Rev. C. E. Y. Kendall.
Notts.—Sub-var. *subalbida*, Scarthgimoor, Sept. 1883 ! C. T. Musson.
Derby—Repton, Rev. H. Milnes. Matlock, J. A. Howe. Miller's Dale, ::045, J. Kidson Taylor.
Lancashire Mid—Newsham, May 1888 ! R. Standen.
York N.E.—Castle Hill, Scarborough, rare, J. A. Hargreaves.
York S.W.—Cawthorne, May 1890 ! Lionel E. Adams. Lofthouse, G. Roberts.
York Mid W.—Collingham, Sept. 1908 ! A. Hartley. Otley, Oct. 1886 ! J. A. Hargreaves. Near York, 1881, R. Miller Christy. Sub-var. *subalbida*, Garforth, Aug. 1908, W. Harrison Hutton.
Westmorland and Lake Lancashire—Not uncommon in the Allithwaite and Cartmel roads, G. H. Taylor.
Cumberland—Bassenthwaite, Capt. W. J. Farrer.

SCOTLAND.

Berwick—A "var. *purpurascens* Ckll.," Eyemouth, Sept. 1905, W. Evans.

Sutherland E.—Sub-var. *subalbida*, the Mound, Brora, June 1885 ! W. Baillie.

IRELAND.

Louth—Sub-var. *subalbida*, Ardee, April 1905 ! P. H. Grierson.

Queen's Co.—Rathdowney, R. A. Phillips.

FOREIGN DISTRIBUTION.

Germany—Sub-var. *albina* recorded from Alsace by Meyer.

France—Recorded by Picard from the Somme; by Bouchard-Chantereaux from Pas-de-Calais; and by Moquin-Tandon from the Basses Alpes and Foix, Ariège, and with formula 00305 from Paris. Reported from Pontarlier, Doubs, by Mr. Collier.

Russia—The pale greenish form is cited from Livland by Schrenk.

Norway—Sub-var. *grisea*, 12345, and sub-var. *isabellina*, 00000, reported from Jarlsberg by Esmark.

United States—From Massachusetts, Prof. T. D. A. Cockerell records sub-var. *subalbida* from Magnolia and Rockport; and Mr. C. W. Johnson as being abundant on the steep bluff by the lighthouse, Chatham.

Var. *lutea* Picard.

Helix hortensis var. *lutea* Picard, Moll. Somme, 1840, p. 215.

Helix hortensis var. *flavovirens* Picard, l.c.

Helix hortensis var. *subglobosa* Binney, Journ. Boston Soc. N.H., 1837, i., p. 485. pl. xvi.

Helix hortensis var. *griseo-lutea* Esmark, Journ. of Conch., 1886, p. 109.

Helix hortensis var. *lutescens* Schmidt, Verz. Binnenmoll. Norddeutsch., 1857, p. 22.

Helix hortensis v. *lutea unicolor* Boycott and Howell, Contr. Fauna Heref., 1899, p. 63.

The var. *lutea* s.s. is defined as of a more or less vivid yellow.

The sub-var. *flavovirens* Picard is greenish-yellow; the var. *flavoviridis* Kickx is probably quite identical.

The sub-var. *subglobosa* is described by Prof. T. D. A. Cockerell (Nautilus, 1890, p. 140), as greenish or brownish-yellow or honey colour, with the pale yellow parietal wall sharply defined.

The var. *griseo-lutea* of Esmark may be regarded as possessing a dulled yellow shell, and is also probably identical or allied with the var. *helvola* of Kickx.

The sub-var. *lutescens* includes the paler and less brilliant shades of yellow.

This variety is co-extensive in distribution with the species itself, and except for the Neartic region, localities are here cited for the sub-varieties only.

According to Mr. Hawkins, of York, the most brilliantly coloured and finest specimens live on the Willow herb (*Epilobium hirsutum*); its sub-varieties are less universally known.

The unicolorous form is the var. *lutea unicolor* of Boycott and Howell (op. cit.); and the fasciate forms are the var. *lutea fasciata* of the same authors. The following formulæ have been named by French authors:—

1 2 3 4 5	var. <i>quinquevittata</i> Moq. if the ground colour be bright yellow, and var. <i>lafondia</i> Locard if the ground colour be yellowish.	1 0 3 0 5	var. <i>moulinsia</i> Moq.
		1 0 0 4 5	var. <i>terveria</i> Locard, and var. <i>debeauxia</i> Locard.
(12345)	var. <i>bouchardia</i> Moq. when the bands are black-brown, and var. <i>putonia</i> Moq. when of a chestnut colour.	0 0 3 4 5	var. <i>menkea</i> Moq.
		0 0 3 (4) 5	var. <i>robelinia</i> Moq.
(123)45	var. <i>charpentieria</i> Moq., and var. <i>paubuccia</i> Locard.	0 0 3 : 5	var. <i>forestia</i> Locard.
		0 0 : 4 5	var. <i>mermetia</i> Moq.
12(34)5	var. <i>philbertia</i> Moq.	: : : 0 0	var. <i>hidalgoia</i> Locard.
12(34)5	var. <i>brumatia</i> Moq.	0 0 : : :	var. <i>terveria</i> Moq.
123(45)	var. <i>dronetia</i> Moq.	1 0 3 0 0	var. <i>folinia</i> Locard.
123(45)	var. <i>astieria</i> Moq.	1 0 0 0 5	var. <i>michaudia</i> Locard, and var. <i>mayeria</i> Locard.
1 : 3 4 5	var. <i>moreletia</i> Moq., and var. <i>bellardia</i> Locard.	0 0 0 : 5	var. <i>fibrea</i> Moq.
		0 0 0 : :	var. <i>duvalia</i> Moq.
: : : 4 5	var. <i>coquandia</i> Moq., and var. <i>jeninsia</i> Moq.	0 0 3 0 0	var. <i>sarratia</i> Moq. when the ground colour is vivid yellow and the band visible on the upper whorls; var. <i>klesia</i> Moq. when the band is present on body whorl only; and var. <i>guyotia</i> Moq. when the ground tint is clear yellow.
: : : : 5	var. <i>nouletia</i> Moq.		var. <i>morletia</i> Locard.
: : : : :	var. <i>kokeitia</i> Moq.		var. <i>fischeria</i> Moq.
1 2 0 4 5	var. <i>devilliersia</i> Locard.		var. <i>barrandia</i> Moq.
1 0 3 4 5	var. <i>barnesia</i> Moq.	0 0 0 0 5	
0 2 3 4 5	var. <i>venetia</i> Moq.	0 0 0 : 0	
1 2 3 : 0	var. <i>dunkeria</i> Locard.	0 0 0 0 :	
0 : : 4 5	var. <i>bernardia</i> Moq.		
0 : : : :	var. <i>normandia</i> Moq.		

ENGLAND AND WALES.

- Cornwall W.**—Sub-var. *lutescens*, St. Austell, J. K. Taylor. Truro! J. H. James.
Somerset N.—A var. *lutea-lurida* Williams (yellow shell with faintly darker bandings) is recorded from hedgebanks at Holbrooke near Wincanton, and on hill-tops at Milton Cleveland and Penselwood by Mr. E. W. Swanton. Sub-var. *lutescens*, Blagdon and Bilton near Bath! Miss Hele.
Wilts. S.—Sub-var. *lutescens*, Devizes, July 1910, C. D. Heginbotham.
Dorset—Sub-var. *lutescens*, Bridport, Aug. 1884! S. C. Cockerell.
Isle of Wight—Sub-var. *lutescens*, Freshwater, Sept. 1886! J. W. Wood.
Sussex E.—Sub-var. *lutescens*, Brighton, J. Kidson Taylor. Eastbourne, Rev. S. Spencer Pearce.
Kent E.—Sub-var. *flavovirens*, near Folkestone, Aug. 1896, C. E. Wright.
Kent W.—Sub-var. *lutescens*, Chislehurst, T. D. A. Cockerell.
Essex N.—Sub-var. *lutescens*, Colchester, J. Kidson Taylor. Hartford End! R. M. Christy.
Middlesex—Sub-var. *lutescens*, Boston road, Hanwell, Sept. 1883! Mrs. Skilton.
Suffolk W.—Sub-var. *lutescens*, Lavenham, A. Mayfield.
Norfolk E.—Sub-var. *lutescens*, Norwich, 1858, H. J. Bellars.
Northampton—Sub-var. *lutescens*, Peterborough, 1858, H. J. Bellars.
Carmarthen—Sub-var. *lutescens*, Laugharne, Sept. 1883! C. Jefferys.
Rutland—Sub-var. *lutescens*, Morecott, E. Collier.
Notts.—Sub-var. *lutescens*, Scarthingmoor, Sept. 1883! C. T. Musson.
Derby—Sub-var. *lutescens*, A. Schmidt, feeding on garlic, Ashover, May 1882, L. E. Emmett. Miller's Dale, J. Kidson Taylor.
Cheshire—Sub-var. *lutescens*, Brook Lane, and Saltney near Chester, H. J. Bellars.
Lancashire S.—Sub-var. *lutescens*, Clitheroe and Chorlton, J. Kidson Taylor.
York S. W.—Sub-var. *lutescens*, Ackworth! R. M. Christy.
York Mid W.—Sub-var. *lutescens*, Studley! J. Ingleby.
Cumberland—Sub-var. *flavovirens*, The Scaur, Mrs. G. B. Longstaff.

IRELAND.

- Dublin**—Sub-var. *lutescens*, Finglas quarry near Dublin, Aug. 1888! J. R. Redding.

FOREIGN DISTRIBUTION.

Germany—A pale yellow variety with the first whorls greenish-yellow, recorded as the sub-var. *flavovirens*, Tegernsee, Upper Bavaria, is recorded by Walser; sub-var. *lutescens* was found by Mrs. Fitzgerald on the Mittenwald road, Garmisch, Bavaria; is recorded from Halberstadt by Schmidt, and from Berlin by Stein.

France—Sub-var. *lutescens* found at Bordeaux, Gironde, by Dr. Scharff; sub-var. *flavovirens*, is recorded by Moquin-Tandon from Soréze, Tarn; by M. Letourneux from Vendée; and M. Bouchard-Chantreaux describes a yellow variety with grey bands from Pas-de-Calais.

Russia—Sub-var. *flavovirens*, recorded by Schrenk from Euseküll, Livland.

Sweden—Sub-var. *lutescens*, Tveta, Oland (Westerlund, Exp. Crit., 1871, p. 40).

Canada—In Quebec Province it is recorded as common at Barachois, Gaspé Peninsula, by Mr. A. W. Hanham; and by Mr. G. H. Clapp from Grand Entry, Magdalen Islands.

Sub-var. *subglobosa* was recorded in 1843 by Mr. de Kay from the banks of the St. Lawrence, two hundred miles below Quebec.

In Nova Scotia, sub-var. *subglobosa* is recorded by Binney and Bland as found at Halifax by Mr. Villins.

On Newfoundland the var. *lutea* is recorded from Little Codroy Valley by Prof. Cockerell; and from Hawkes Bay by Mr. C. W. Johnson.

On Prince Edward Island it is recorded from Kirtan Island, by Mr. Johnson.

United States—Var. *lutea* is recorded for Massachusetts by Mr. J. H. Thomson from Gay Head, Martha's Vineyard; by Mr. C. W. Johnson from Provincetown and the Island of Tuckernuck; by Dr. Pilsbry from Sciasconset, Nantucket Island; and by Prof. Cockerell from Magnolia and Rockport, at the latter place the formulae 00000, 12345, 123 45, (123)(45), 10345, 12045, etc., have been found by Mr. Clapp.

The sub-var. *subglobosa* is recorded by Mr. Amos Binney as found commonly on the lower parts of Cape Cod and Cape Ann, and as abundant in 1837 on Salt Island, and at that time the only variety present; and by Prof. Cockerell from Magnolia and Rockport.

The sub-var. *lutescens* has been found among cedars near the "Old Harbour," Cohasset, by Mr. A. P. Morse.

For Maine, the var. *lutea* was recorded in 1843 by Dr. J. W. Mighels as found on a little island in Casco Bay by Capt. Walden; and with the sub-var. *subglobosa* was collected by Prof. A. S. Packard on Brown Cow Island in the same bay.

Var. *incarnata* Picard.*Helix hortensis* var. *incarnata* Picard, Moll. Somme, 1840, p. 215.*Helix hortensis* var. *colorata* Dumont and Mortillet, Moll. Savoie, 1857, p. 88.*Helix hortensis* var. *fagorum* Weinland, Nachr. Deutsch. Mal. Ges., 1874, p. 34.*Helix hortensis* var. *bicolor* Cockerell, Brit. Nat., June 1891, p. 121.The var. *incarnata* is described as of a bright rose colour.The sub-var. *colorata* is rose colour, tending to fawn, lip and rib brown, lip darkest, a yellow or reddish transverse band before the rib externally.The sub-var. *fagorum* is reddish-grey or flesh colour, simulating the colour of dead beech leaves, and was named *fagorum* on account of the assumed protective character of its colouring.The sub-var. *bicolor* Ckll., is "pink, with the upper part of the spire yellow."It is also probably the var. *carnea* of Esmark.Upon a flesh-coloured ground the band modification 12345 has been named var. *alderia* by Moquin-Tandon; the var. *lespesia* Moq. indicates the formula 1(23)45 when the ground colour is of a rosy tint.

ENGLAND.

Cornwall W.—Truro, 1885, J. H. James.

Devon S.—Alphington, E. D. Marquand. Dawlish, 1909, C. E. Wright.

Somerset N.—Near Minehead! Lionel E. Adams. Penselwood and frequent about Wincanton, E. W. Swanton. Blagdon, J. Kidson Taylor. Bitton near Bath, Miss F. M. Hele.

Wilts. S.—Stourton, E. W. Swanton.

Dorset—Charminster, 1888! T. F. Burrows. Spettisbury! Charles Ashford. Bridport, Sept. 1895; and Swanage, Oct. 1901, C. E. Wright.

Hants. S.—Christchurch, C. Ashford. Ringwood, Aug. 1902; Redbridge, Aug. 1900; and Pokestone, Oct. 1901, C. E. Wright. Common in woods, Winchester, J. R. le B. Tomlin. Fordingbridge, July 14, 1883! Hugh Richardson. Sub-var. *bicolor* Ckll., Petersfield, Mrs. Cusack (T. D. A. Cockerell, l.e.).

Hants. N.—Preston Candover, 1883, Rev. H. P. Fitzgerald.

Isle of Wight—Freshwater, July 1886! J. W. Wood.

Sussex W.—Midhurst, Aug. 1884, T. D. A. Cockerell. Lavant, Sept. 1901, C. E. Wright.

Sussex E.—Hurst Green, Aug. 1884, T. D. A. Cockerell.

Kent W.—Paddock Wood, Merewith, and Eynsford, Aug. 1884; and Bickley, June 1883! T. D. A. Cockerell. Swanley, Rev. J. W. Horsley.

Kent E.—Ashford, July 1883! Miss Fairbrass. Maidstone, H. Elgar and H. Lamb. Canterbury! H. C. Napier.

Surrey—Roadside by Epsom Downs, April 1888, W. Whitwell. Dorking and Shiere, Aug. 1884; Caterham and Warlingham, Sept. 1884; var. *incarnata* and sub-var. *bicolor*, by the River Thames, Kew, T. D. A. Cockerell.

Essex N.—Braintree, May 1908, C. E. Wright. Colchester, J. Kidson Taylor.

Herts.—In old chalk-pit near Swiss Cottage, Cassiobury Park, Oct. 1883; and St. Albans, July 1883! John Hopkinson.

Middlesex—Brentford, Apr. 1884, T. D. A. Cockerell. Ealing & Hanwell, A. Belt.

Oxford—Cothill, Sept. 1907! H. C. Napier.

Suffolk W.—Lavenham, A. Mayfield.

Suffolk E.—Needham Market and Mendlesham, A. Mayfield.

Norfolk E.—Catton near Norwich, 1858, H. J. Bellars. Sprowston, A. Mayfield.

Norfolk W.—King's Lynn, Oct. 1894! T. Petch.

Bedford—Dallow lane, Luton, Oct. 1886! J. Saunders.

Northampton—Peterborough, 1858, H. J. Bellars. Duston, 00005, July 1905, Rev. W. A. Shaw. Stone quarries, Blisworth, July 1905;] Wansford, Nov. 1908; and Weekley, Oct. 1901, C. E. Wright.

Hereford—Kington, Oct. 1885, C. T. Musson.

Leicester and Rutland—Great Casterton, June 1905! J. Hawkins.

Derby—Matlock and Miller's Dale, Thos. Glover.

Cheshire—Brook lane, Chester, 1858, H. J. Bellars.

Lancashire S.—Sankey lane, Warrington, 1858, H. J. Bellars.

Lancashire Mid—Newsham, 1887! R. Standen.

York S.W.—Bracken Hill near Ackworth, H. Richardson.

York Mid W.—Ripley, Sept. 1883! F. T. Walker. Sub-var. *colorata*, canalside, Keighley, Sept. 1902! F. Booth.

SCOTLAND.

Lanark—Near Glasgow! R. Standen.

IRELAND.

Wicklow—Greystones, 00000 and 12345! R. F. Scharff.

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *fagorum*, Hohen-Wittlingen, near Urbach, Wurtemberg, D. F. Weinland; Minden, Westphalia! Hugh Richardson; and Biensdorf, near Pirna, and Tharand, Saxony! J. H. Ponsonby.

Belgium—Recorded from Vielsalm, Luxemburg, and other places by M. Colbeau.

France—Reported by Mr. E. Collier from Pontarlier, Doubs, and as exceptionally rich in colour when living on the nut bushes at 3,500 feet altitude, Corbeyrier-sur-Aigle, Savoy, Sept. 1903; Mr. S. C. Cockerell records it from Veules, Seine Inférieure; Bouchard-Chantreaux from Pas-de-Calais; Locard from Lyons and from the Ain; Abbe Dupuy from Pyrénées Orientales; Picard from the Somme; and Moquin-Tandon cites Sorèze, Tarn, and sub-var. *alderia*, 12345, from Toulouse, Haute Garonne. Dumont and Mortillet record sub-var. *colorata* from St. Cergues, Jura, etc.

Switzerland—Olten, Solothurn, 1908, Hugh Watson.

Austro-Hungary—Herr Slavik cites the red variety from near Reichenberg and Pardubitz, Bohemia.

Var. *baudonia* Moquin-Tandon.

Helix hortensis var. *baudonia* Moquin-Tandon, Hist. Moll., 1855, p. 171.

Helix hortensis var. *pallide castanea* Westerlund, Exp. Crit., 1871, p. 40.

The var. *baudonia* is described as fawn coloured.

The sub-var. *pallide castanea* indicates a pale chestnut shell.

The vars. *cornea* and *cornea-subfusca* of Bouchard-Chantreaux are probably forms of this variety.

The following formulæ have been noted and named by French authors :

1(23)(45) var. *milletia* Moq. 00345 var. *fagotia* Locard.

10305 var. *bernardia* Locard.

If the ground colour be of a reddish-fawn, the var. *aleronia* Moq., 12345, is distinguished, and the var. *reclusia* Moq., 10345, has the banding only faintly pigmented.

The common Blackthorn (*Prunus spinosa*) is recorded by Mr. Hawkins, of York, as yielding the best specimens of this variety.

ENGLAND.

Somerset N.—Cheddar, (123)(45), J. Kidson Taylor.

Dorset—Chideock, (123)(45), (123)(45), (12345), and (12)3x x(45), A. Belt.

Hants. N.—Swarraton, Sept. 1892! Rev. W. L. W. Eyre.

Sussex E.—Mountsfield, Robertsbridge, and Lamberhurst, Aug. 1884, T. D. A. Cockerell.

Kent E.—Folkestone, 1885! Miss F. M. Hele.

Kent W.—Eynsford, Aug. 1884, T. D. A. Cockerell.

Surrey—Godalming, Aug. 1884, T. D. A. Cockerell.

Derby—Matlock, 1885! H. E. Craven.

Cheshire—Brook lane, Chester, 1858, H. J. Bellars. Altham, 1889! R. Wigglesworth.

Lancashire S.—Sankey lane, Warrington, 1858, H. J. Bellars.

York S.E.—Cottingham and near Hull, 00000 and 00300! F. W. Fierke.

York N.E.—Scalby road, Scarborough, Sept. 1903!

York Mid W.—St. Mary's, York! W. Denison Roebuck.

York S.W.—Keighley, 10045, J. Kidson Taylor. Lofthouse, G. Roberts.

Durham—Durham, July 1885! Baker Hudson.

SCOTLAND.

Lanark—Glasgow, 12345, J. Kidson Taylor.

CONTINENTAL DISTRIBUTION.

Germany—Minden, Westphalia, Hugh Richardson. Herr Tischbein has recorded the presence of a peculiar brown variety in the vicinity of leather tanneries at Herresheim in Bielefeld, which are probably referable to this form.

France—Recorded by Locard from Lyons and from the Ain; by Dupuy from Pyrénées Orientales; by Moquin-Tandon from Luchon, Haute Garonne; and a larger form from the Valley de Carol, Pyrenees. The formula 10345 with only slightly pigmented bands from Lyons; and a larger form in the Valley de Carol; (123)(45), Agen, and 12345 on a reddish-fawn ground, Sorèze, Tarn.

Sub-vars. *cornea* and *cornea-subfusca* are cited by Bouchard-Chantreaux from Pas-de-Calais; and a var. *subfusca* by Dr. Grateloup from Dax, Landes.

Spain—Alcala de la Selva, Ternel, Aragon! Dr. J. G. Hidalgo.

Scandinavia—Sub-var. *pallide castanea* (Westerlund, l.c.).

Var. *lilacina* Taylor.*Helix hortensis* var. *lilacina* Taylor, Journ. of Conch., 1883, p. 34.*Helix hortensis* var. *pallida* Cockerell, Nautilus, 1890, p. 140.The var. *lilacina* has a shell of a bluish-violet colour.The sub-var. *pallida* Ckll. is of a pale purplish or purplish-brown colour.The most characteristic examples of this variety are beautifully delicate, and about York are, according to Mr. Hawkins, found feeding upon Ground Ivy (*Nepeta glechoma*).

ENGLAND AND WALES.

Devon S.—Topsham, Aug. 1892 ! Lionel E. Adams.

Somerset N.—Bath, June 1886, Miss Fairbrass. Var. *lilacina*, Holbrooke, Bratton St. Maur; and sub-var. *pallida*, Bratton St. Maur, and Cuckoo Hill near Bruton, E. W. Swanton; Hatch Beauchamp, Rev. E. W. W. Bowell.Hants. S.—Hartley Maudit near Alton, Aug. 1895 ! S. C. Clapham. Sub-var. *pallida*, Hayling, June 1896, C. E. Wright.

Sussex E.—Mountfield, Aug. 1884, T. D. A. Cockerell.

Kent W.—St. Mary Cray, Aug. 1883; Eltham, May 1884 ! Wrotham, Aug. 1884; and amongst ivy at Chislehurst, 1883, T. D. A. Cockerell.

Kent E.—Swanley, Rev. Canon Horsley. Preston near Faversham, July 1883, Miss Fairbrass; and Canterbury, 00300, C. E. Wright.

Surrey—Addington, July 1899, A. Reynell.

Essex N.—Plentiful at Colchester and Dovercourt, Aug. 1896, the specimens tinged with diaphanous yellow, *lutea-lilacina*, C. E. Wright.

Bucks.—Wendover, Aug. 1909 ! C. Oldham.

Suffolk W.—Sudbury, E. Ransom.

Norfolk E.—Sub-var. *pallida* Ckll., Catton, A. Mayfield.Norfolk W.—North Runcton and Gaywood, also sub-var. *pallida*, Lynn, Oct. 1894 ! T. Petch.Northampton—Swarming in hedges, Warkton, May 1895; quarries, Blisworth, June 1895; with translucent banding, Stamford road, Kettering, July 1896, C. E. Wright. Sub-var. *pallida* Ckll., Middleton, Aug. 1898; Loddington, Sept. 1898; and at Gutton, where the banded forms 10045, 10005, 00045, 00005, and 12045 occur, C. E. Wright. Duston and Towcester road, Northampton, W. H. Hollis.

Gloucester W.—Little Bourton near Bristol ! Rev. W. L. W. Eyre.

Worcester—Sub-var. *pallida*, Wilden, June 1888, J. W. Williams.

Carmarthen—Laugharne, 1885, J. H. James.

Flint—Bagillt, 1858, H. J. Bellars.

Lincoln N.—At “thrush stones” and on Ground Ivy at Read’s quarry, Broughton Wood, May 1905, Rev. E. A. Woodruffe-Peacock. Sub-var. *pallida* Ckll., Burwell and Haugham Woods, Aug. 1886 ! H. Wallis Kew.Leicester and Rutland—Leicester, Rev. C. E. Y. Kendall. Great Easton, 10045, Sep. 1898; var. *lilacina* and sub-var. *pallida*, Uppingham, July 1899, C. E. Wright.

Notts.—Tuxford, July 1883 ! W. A. Gain.

Derby—Matlock, H. E. Craven. Sub-var. *pallida*, Matlock, Thos. Glover; and Miller’s Dale, Aug. 1903, J. W. Jackson.

Cheshire—Brook lane, Chester, 1858, H. J. Bellars.

Lancashire Mid—Newsham, June 1887 ! R. Standen.

York Mid W.—Otley, 1886 ! J. A. Hargreaves. Aberford, July 1909 ! A. Hartley.

York S. W.—Canal banks, Idle, 1888, F. Rhodes. Cawthorne, Barnsley, July 1904 ! W. E. Brady. Lofthouse, G. Roberts.

IRELAND.

Kildare—Monasterevan, Sept. 1910, A. W. Stelfox and R. A. Phillips.

Queen’s Co.—Rathdowney, R. A. Phillips.

King’s Co.—Birr, R. A. Phillips.

FOREIGN DISTRIBUTION.

Norway—Christiania and Jarlsberg, Miss Esmark.

United States—Sub-var. *pallida*, Magnolia, Mass., T. D. A. Cockerell.Var. *olivacea* Taylor.*Helix hortensis* var. *olivacea* Taylor, Journ. of Conch., 1883, vol. iv., p. 34.*Helix hortensis* var. *filholia* and *simonia* Moquin-Tandon, Hist. Moll., 1855, ii., p. 171.*Helix hortensis* var. *hepatica* Esmark, Journ. of Conch., 1886, vol. v., p. 109.*Helix hortensis* var. *grisea-brunnea* Esmark, op. cit.*Helix hortensis* var. *roseo-hepatica* Esmark, op. cit.*Helix hortensis* var. *de corti* Schlesch, Fauna Danemarks, 1907.

SHELL of a deep olive-brown colour.

The sub-var. *filholia* is described as "olivaceous."

The sub-var. *simonia* is described as "brown."

The sub-var. *grisea-brunnea* is a descriptive name, and probably implies a paler and less pure brown.

The sub-var. *hepatica* is a descriptive name, and expresses a liver colour.

The sub-var. *roseo-hepatica* is probably intended to distinguish the liver-coloured shells with a perceptibly rosy shade.

The sub-var. *de corti* is described as "greenish-black, lip red-brown."

A var. *picea* is recorded without description by Meyer; it is probably identical with the sub-var. *de corti* of Schleich.

Mr. J. Hawkins has observed and placed on record, that about York, the Horehound (*Ballota nigra*) generally yields dark brown or nearly black specimens of this species.

ENGLAND AND WALES.

Devon N.—Ilfracombe, Aug. 1903 (Beeston and Wright, l.c.).

Devon S.—Frequent about Alphington, E. D. Marquand. Moderately common, Topsham, Aug. 1892, Lionel E. Adams.

Somerset N.—Near Bruton, very local, E. W. Swanton.

Wilts. N.—Great Bedwyn (Townsend), E. W. Swanton.

Wilts. S.—Devizes, 1897 ! C. D. Heginbotham.

Dorset—Charminster, T. F. Burrows. A very dark, almost black, example found at Marnhull, by Mr. E. W. Swanton, is probably referable to the sub-var. *de corti* Schleich.

Hants. S.—Christchurch, C. Ashford. Pokestone, Oct. 1901, C. E. Wright.

Hants. N.—Swarraton, 1891 ! Rev. W. L. W. Eyre.

Kent E.—Ewell, July 1896, C. E. Wright.

Surrey—Haslemere, C. Pannell, jr.

Suffolk E.—Mendlesham, A. Mayfield.

Hunts.—St. Neots, 00300, Sept. 1905 ; Buckden, 00300, Sept. 1909 ; and Great Raveley, Oct. 1909. C. E. Wright.

Northampton—Swarming in hedges, Warkton, May 1895 ; Isham, June 1896 ; Stamford road, Kettering, July 1896 ; and Weekley, Oct. 1901, C. E. Wright. Barton Seagrave, W. H. Hollis.

Glamorgan—St. Fagan's near Cardiff, 1887, F. W. Wotton.

Flint—Bagillt, 1858, H. J. Bellars.

Lincoln S.—Deeping St. James, Rev. C. E. Y. Kendall.

Rutland—Ketton, July 1899, C. E. Wright.

Derby—Matlock, J. A. Howe.

Cheshire—Brook lane, Chester, 1858, H. J. Bellars.

York N.E.—Scalby road, Stepney Hill, Stainton Dale, and Throxenby, J. A. Hargreaves.

York Mid W.—Common on the ashed railway embankment at Apperley in 1888, but now exterminated by the formation of the new line, F. Rhodes. In hedgerow by footpath from St. Mary's, York, to Scarborough railway bridge ! (R. M. Christy, Zool., 1881, p. 245). Collingham, J. Kidson Taylor. Boston Spa, J. Emmet.

SCOTLAND.

Berwick—Eyemouth, Mrs. Carphin.

Forfar—Arbroath ! Alex. Somerville.

Sutherland E.—Mound near Brora ! W. Baillie.

Sutherland W.—Tongue ! W. Baillie.

IRELAND.

Dublin—A pale form, Finglas quarry, Dublin, Aug. 1886 ! J. R. Redding.

Kildare—Monasterevan, Sept. 1910, A. W. Stelfox and R. A. Phillips.

Queen's Co.—Rathdowney, 1908, R. A. Phillips.

King's Co.—Birr, 1908, R. A. Phillips.

CONTINENTAL DISTRIBUTION.

Germany—Reported by Mr. F. H. Sikes from Georgenthal, Thuringia. A var. *picea* with formulae 12345 and (12345) is recorded by Meyer from Metz, Lorraine ; and the sub-vars. *filholia* and *simonia* from the same district by Moquin-Tandon.

Norway—Sub-var. *hepatica*, 12345, Lillesand and Hof in county of Jarlsberg ; 00000, Lysaker, near Christiania ; (12)345 and 1204, also sub-var. *roseo-hepatica*, 00000, Jarlsberg. Sub-var. *grisea-brunnea*, 00000, Jarlsberg, Fredriksvaern, and Christiania. At Laurvik the specimens are semitransparent (Esmark, l.c.).

VARIATIONS IN BANDING OF SHELL.

Var. *fasciata* Moquin-Tandon.

Helix hortensis vars. *unifasciata*, *bifasciata*, *trifasciata*, *quatuor fasciata*, *quinque fasciata*, and *interrupta* (Picard, Moll. Somme, 1840, p. 215-217).

Helix hortensis vars. *fasciata*, *coalita*, *interrupta*, *punctella* (Moquin-Tandon, Hist. Moll. France, 1855, p. 167).

SHELL with dark spiral banding, which may be continuous, interrupted, or coalesced, and includes all spirally fasciate forms. The name was first applied by Menke (Syn. Moll., 1830) without description.

The var. *fasciata* Moq., s.s., is applied only to shells with distinct bands, and other than five in number. The var. *fasciata* of Boycott and Howell (op. cit.) is restricted to shells with a white or yellow ground, but is unrestricted in its number of bands.

The sub-var. *interrupta* of Picard and Moquin-Tandon has the spiral fasciation interrupted.

The sub-var. *punctella* Moq. shows the bands still further disintegrated and broken up into spots.

The sub-var. *coalita* Moq. has the spiral banding more or less fused together or coalesced, forming one or more broad combined bands.

The five-banded form is the *quinquefasciata* of Picard, the *quinquevittata* of Moquin-Tandon.

The sub-var. *quatuor fasciata* Picard possesses four apparent bands, the most interesting arrangement in this group being 1(23)45.

The sub-var. *trifasciata* Picard shows only three apparent bands, a striking example being 1(234)5.

The sub-var. *bifasciata* Picard embraces the shells showing only two bands, whether these be simple or composite, the two most remarkable instanced by the author being (12)300 and 1(2345).

The sub-var. *unifasciata* Pic. embraces the shells showing a single band only.

The sub-vars. *sexfasciata* Picard and *septemfasciata* Picard, which show six and seven bands respectively, are, as in *H. nemoralis*, due to the dismemberment of one or more of the five normal bands.

The sub-var. *infra fasciata* of Cockerell indicates those shells with the bands quite deficient above the periphery, and only bearing the most basal zone beneath; it is represented by the formula 00005; and is identical with the sub-vars. *morletia* of Locard and *barraudia* of Moquin-Tandon.

The var. *fasciata* and its many modifications are distributed throughout the range of the species, and a citation of the records of the more ordinary variations would fill many pages; therefore, apart from the American distribution, only the localities of some of the more uncommon forms are enumerated.

ENGLAND.

Dorset—A septemfasciate shell, (12)3x(45), Chideock, A. Belt.

Hants. N.—A sexfasciate shell, 12x3(45), Swarraton, Rev. W. L. W. Eyre.

Kent W.—A sexfasciate shell, 123x45, Ruxley near Swanley, 1901, J. Moorcock.

Middlesex—A sexfasciate shell, (123)x(45), Sion lane, Brentford, 1884! Mrs. Skilton

Bucks.—Septemfasciate and octofasciate specimens, 1(23)(4+5), 1(2+3+4+5), and 1(2+3+4)5, Aylesbury, Rev. E. Percy Blackburn.

Stafford—Sexfasciate, septemfasciate, and novemfasciate shells, (1233445), (1234+5), (12)34+5, and (1+2+3+4+5), Baggeridge Woods, near Dudley, Aug. 1906, Rev. E. Percy Blackburn.

Derby—A sexfasciate shell, 1(23)(445) Matlock, 1884! H. E. Craven.

York S.E.—A septemfasciate shell, 123(4+5), Flambro', 1903, Rev. E. P. Blackburn.

York N.E.—A sexfasciate specimen with formula 123x45, labelled "Malton," in the British Museum.

FOREIGN DISTRIBUTION.

Germany—A septemfasciate specimen is recorded by Dr. Weinland from Hohen Wittlingen, Wurtemberg.

Belgium—M. Colbeau records a septemfasciate specimen found by M. Sauveur at Vielsalm, Luxemburg.

Switzerland—Sexfasciate and septemfasciate shells, the latter showing traces of an eighth band, are recorded from St. Gall by Dr. Hartmann.

Canada—In Quebec Province on the Gaspé Peninsula the banded and unbanded varieties are equally common, Mr. G. H. Clapp reporting the formulæ 12345, 123(45), (123)(45), 1(234)5, (12345), and 00000 as obtained from Gaspé, and the formula (12345)

is reported from Barachois by Mr. C. W. Johnson. On Grand Entry, Magdalen Islands, the formulæ 12345, (12)345, and 12045 were found, the type being most prevalent, but showing a tendency to become (12)345.

On Newfoundland, Mr. Gratacap found the formulæ 12345, (12345), and (123)45, in the Little Codroy Valley; Mr. G. H. Clapp records (12345) and 1(234)5 from near the head waters of Robinson's River, and (12345) was found at the mouth of East River, Hawkes' Bay, by Drs. Townsend and Allen.

United States—In Massachusetts the fasciate variety was recorded in 1851 by Mr. Amos Binney as not uncommon on Salt Island, where it was quite unknown in 1837, the unicolorous form, *H. subglobosa*, being the only form of the species living thereon at that time. Dr. Gould in the same year recorded it as inhabiting House Island and Outer Gooseberry Island, each islet possessing a different scheme of banding. Fasciate forms are also reported from Gloucester and Kettle Island by Mr. H. Prime. Dr. Pilsbry cites the four and five-banded forms from Sciasconset, Nantucket Island; Mr. G. H. Clapp has found the formulæ 12345, 123(45), (123)(45), 10345, 12045, etc., at Rockport, but the bands were mostly only faintly indicated; and Prof. Cockerell records the five-banded and other varieties from Magnolia.

In Maine Dr. J. W. Mighels in 1843 reported *quinquevittata* and other banded forms being found by Capt. Walden on one of the little islands in Casco Bay.

On Brown Cow Island Dr. Packard found that banded shells constituted about a tenth of the total number.

On Seal Rock, one of the Matinicus group, Mr. Bryant found only the five-banded form; and from Cape Porpoise, Kennebunkport, Mr. Clapp reports (12345).

Var. *undulata* Taylor, var. nov.

SHELL with the longitudinal or spiral banding broken up and fused together transversely at more or less regular intervals.

ENGLAND.

Hants. S.—Christchurch, June 1881, Charles Ashford. Hayling, June 1896, C. E. Wright.

Kent E.—Folkestone, 1885! Miss Hele.

Northampton—Oundle, Sept. 1905; and Weekley, Oct. 1901, C. E. Wright. Barton Seagrave and Hunsbury Hill, Northampton, W. H. Hollis.

Hunts.—Buckden, Sept. 1909, C. E. Wright.

CONTINENTAL DISTRIBUTION.

Switzerland—Figured and recorded from Aarau, Canton Aargau, by Hartmann.

Var. *bicolor* Picard.

Helix hortensis var. *bicolor* Picard, Moll. Somme, 1810, p. 216.

The sub-var. *bicolor* Picard is described as having the upper half of the whorls pale yellow and the lower half a slightly livid greenish-yellow, with a narrow whitish area of separation. The typical shells had indications of two pale and very narrow bands above the periphery.

ENGLAND.

Northampton—Northampton road, Kettering, with formulæ 00000, 00300, and 12345, July 1895! C. E. Wright.

Hereford—Boycott and Bowell allude to specimens occasionally found in the county, which are referable to this variety.

CONTINENTAL DISTRIBUTION.

France—Described from specimens found in the Somme by M. Picard.

VARIATION IN COLOUR OF BANDING.

Var. *citrinazonata* Taylor, var. nov.

SHELL with yellow banding.

ENGLAND.

Devon N.—Ilfracombe, very scarce, Aug. 1903 (Beeston and Wright, l.c.).

Dorset—Bridport, Sept. 1905, C. E. Wright. Stour Provost, May 1906, Rev. W. A. Shaw.

Hants. S.—Hayling, June 1896, C. E. Wright.

Sussex W.—Lavant, Sept. 1901, C. E. Wright.

Kent W.—Tovil, Oct. 1901, C. E. Wright.

Northampton—Isham, June 1896; Middleton, Aug. 1898; Glendon, Sep. 1899; Rockingham, June 1899, C. E. Wright. Hunsbury Hill, Northampton, W. H. Hollis.

Denbigh—Llandudno, Sept. 1870! W. Denison Roebuck.

Var. **viridizonata** Cockerell.*Helix hortensis* var. *viridizonata* Cockerell, Nat. World, 1885, p. 145.

SHELL pale, with apple-green bands.

This name was applied by Prof. Cockerell to a shell figured by Prof. J. G. Hidalgo in his Catalogue of the Land Shells of Spain, Portugal, and the Balearic Isles, published in 1875. I have been favoured by Prof. Hidalgo with a co-type of the shell figured, which is, however, referable to the var. *hyalozonata*, or, more correctly, to a pale form of *citrinozonata* of *Helix nemoralis*, which species Dr. Hidalgo now considers the form to be; the green tint, which was probably in great part due to the body of the animal inhabitant showing through the shell, is now only faintly perceptible, Dr. Hidalgo informing me that it has faded with time.

Mr. C. Clare Fryer (Science Gossip, Nov. 1890), recorded finding at Bourne End, Bucks., *Helix hortensis* with a white ground and banding of an apple-green tint, but I have been unable to get further information or to see the specimen.

Var. **roseozonata** Cockerell.*Helix hortensis* var. *roseozonata* Cockerell, Sci. Goss., 1887, p. 177.

The var. **roseozonata** was originally described as "bands pink," but the author at a later date (Sci. Goss., 1889, p. 44) amplified and supplemented the description by adding "shell pale or whitish with rose coloured bands."

The var. *roseozonata* of Swanton (Guide, Brit. Moll., 1906, p. 50) is slightly different, being described as "straw colour with reddish bands."

ENGLAND.

Cornwall W.—Truro ! J. H. James.

Devon N.—Ilfracombe, scarce, Aug. 1903 (Beeston and Wright, l.c.).

Devon S.—Doubtfully recorded for Teignmouth by Mr. L. St. G. Byne.

Somerset N.—Amongst gorse, Abbott's Hill, Bratton St. Maur, E. W. Swanton.

Wilts. S.—Salisbury, 1909, C. E. Wright.

Dorset—Chideock near Bridport (12345), T. D. A. Cockerell. Swanage, Oct. 1901, C. E. Wright.

Hants. S.—Hartley Maudit near Alton, 12345, Aug. 1895 ! S. C. Clapham. Netley Abbey, June 1896 ; Ringwood, Aug. 1902 ; and Pokestone, Oct. 1901, C. E. Wright.

Sussex W.—Lavant, 10005, June 1896, C. E. Wright.

Sussex E.—Eastbourne, Sept. 1883 ! Rev. S. Spencer Pearce.

Surrey—Common in garden, Manor Park House, Sutton, Sep. 1903 ! F. H. Sikes.

Kent W.—Bickley, 12345 and 123(45), T. D. A. Cockerell. Dartford, F. Taylor.

Kent E.—Ashford, July 1883 ! Miss Fairbrass. Canterbury and Tovil, Oct. 1901, C. E. Wright.

Surrey—Haslemere, 12345, 12045, 12(345), (12)3(45), C. Pannell, jr.

Essex N.—Dovercourt, Sept. 1909, C. E. Wright.

Middlesex—Acton Green, T. D. A. Cockerell.

Berks.—Maidenhead ! Lionel E. Adams.

Norfolk W.—King's Lynn, Oct. 1894, T. Petch.

Northampton—Limestone quarry, Blisworth, Oct. 1894, L. E. Adams ; Dürton, June 1904, Rev. W. A. Shaw. Northampton road, Kettering, 12045, July 1895 ; Isham, June 1896 ; and Roade, Oct. 1899, C. E. Wright.

Rutland—Uppingham, July 1899, C. E. Wright.

York Mid W.—Aberford, A. Hartley.

SCOTLAND.

Ayr—Ardrossan, Aug. 1890 ! A. Shaw.

Perth Mid—Var. *vinosofasciata*, Balgowan, 1884 ! H. Coates.

CONTINENTAL DISTRIBUTION.

Belgium—Rare, with translucent red bands at Hastière, Namur (J. Colbeau, l.c.).

Var. **violaceozonata** Taylor, var. nov.

SHELL with pale violet banding.

ENGLAND.

Devon S.—Seaton, 1882 ! B. M. Oakeshott.

York S.W.—Specimens found by Mr. W. E. Brady at Kexborough, Barnsley, possessed banding with a distinct lilac shade, but the tint was very fugitive.

CONTINENTAL DISTRIBUTION.

Belgium—This unusual form is recorded by M. J. Colbeau as a variety with a white ground and violaceous bands from Furnes, West Flanders, and with a yellow ground and pale violet bands from Arlon, Luxembourg.

Var. *rufozonata* Cockerell.

Helix hortensis var. *rufozonata* Cockerell, Science Gossip, 1887, p. 67.

SHELL yellow, with pale red-brown bands.

That this rufous zonulation is probably due to the environment is shown by the simultaneous occurrence of this variation in *Helix hortensis*, *H. nemoralis* and *H. aspersa*, all within a limited area near Torquay.

ENGLAND AND WALES.

- Devon S.—Torquay, 1886, F. W. Wotton.
 Somerset S.—Bridgwater, Sept. 1884 ! W. Vinson.
 Somerset N.—Bruton, Sept. 1910 ! C. D. Heginbotham.
 Dorset—Lulworth, Aug. 1884 ! S. C. Cockerell.
 Wilts. S.—Devizes, July 1910 ! C. D. Heginbotham.
 Hants. N.—Swarraton, near Alresford, Oct. 1890 ! Rev. W. L. W. Eyre.
 Kent E.—Ashford, 1883 ! Miss Fairbrass. Folkestone, Aug. 1883 ! R. M. Christy.
 Surrey—Warmingham, July 1884 ! S. C. Cockerell.
 Norfolk E.—Catton near Norwich, 1858, H. J. Bellars.
 Northampton—Northampton road, Kettering, July 1895 ! C. E. Wright.
 Gloucester W.—Selsley Hill and Stroud ! E. J. Elliott.
 Glamorgan—East Moors, Cardiff ! F. W. Wotton.
 Lincoln N.—Grisel Bottom, near Louth, Sept. 1889 ! W. Denison Roebuck.
 Luddington, July 1906 ! J. F. Musham.
 Lancashire S.—Warrington, 1858, H. J. Bellars.
 York Mid W.—Bishop Thornton, Jan. 1884 ! W. Storey.

SCOTLAND.

- Haddington—North Berwick, Rev. Dr. McMurtrie.
 Sutherland E.—Brora, April 1890 ! W. Baillie.

FOREIGN DISTRIBUTION.

- Germany—Recorded by Dr. J. P. E. F. Stein from Berlin, Brandenburg.
 France—Cited by Moquin-Tandon as var. *putonia* (12345) from Sorèze, Tarn.
 Canada—Little Codroy River, Newfoundland, L. P. Gratacap.
 United States—Recorded from Massachusetts at Magnolia, by Prof. Cockerell; from Sciasconset, Nantucket Island, by Dr. Pilsbry; and by Dr. Mighels from a little island in Casco Bay, Maine.

Var. *arenicola* Macgillivray.

Helix hortensis var. *arenicola* Macgillivray, Moll. Aberdeen, 1843, p. 83.

Helix hortensis var. *lurida* Moquin-Tandon, Hist. Moll., 1855, p. 167.

Helix hortensis var. *hyalozona*, Baudon, Journ. de Conch., 1884, p. 237.

Helix hortensis var. *albina-fasciata* Williams, Journ. of Conch., 1889, p. 12.

SHELL pale yellow, with translucent unpigmented bands.

The original description by Prof. Macgillivray is:—"Shell subglobose, very thin and diaphanous, with five opaque white bands, the epidermis thin, pale sulphur-yellow, the peristome thin, with an internal opaque white rib. Has a faint alliaceous odour."

The vars. *arenicola*, *hyalozona*, and *albina-fasciata* are strictly identical, and it is also the *fasciata-pellucida* of M. Ancey and Dr. J. S. Gibbons.

Miss Esmark records this form from Norway as v. *albida* with transparent bands.

The sub-var. *lurida* has the bands only partially pigmented, and connects the translucent banded forms and those with fully pigmented banding.

Prof. Macgillivray obtained his specimens of var. *arenicola* from the sandhills about Black Dog Farm, Belhelvie, South Aberdeen, where they abounded unmixed with other forms, and are still found there, the arenaceous habitat suggesting the name *arenicola*, which he applied to it.

The loss of pigment by the spiral banding, which is the characteristic of this variety, has been ascribed to the influence of food or of climatic vicissitudes; as it has been found in several districts of Belgium exclusively upon gooseberry bushes, and in this country has been remarked by several observers to show a preference for the horse radish and wild parsnip; while Herr Dietz has recorded and observers in this country have confirmed that in the present and allied species translucent banded shells are most numerous during wet years, and that although in normal seasons the shells may present strongly pigmented bands, yet a wet season's growth tends to develop banding deficient of the usual colouring.

12345	var. <i>petitia</i> Moq.	00340	var. <i>westerlundia</i> Locard.
10345	var. <i>vallotia</i> Moq.	00300	var. <i>clessinia</i> Locard.

M. Bouchard-Chantereaux has indicated a transparent banded form with a rosy-red ground, as *rosca-fasciis-pellucidis*, and Moquin-Tandon has distinguished a form with a formula of 12345, flesh-coloured ground, as var. *raymondia*.

ENGLAND AND WALES.

Devon S. — Alphington, E. D. Marquand. Topsham and Culverhole Point,
Aug. 1892, Lionel E. Adams. Dawlish, 1909, C. E. Wright.

Somerset S.—Flax Bourton, (123(45), Sept. 1892 ! Rev. W. L. W. Eyre.

Wilts. S.—Devizes, 123(45), June 1897 ! C. D. Heginbotham. Edington and Mere, E. W. Swanton.

Dorset—Chideock near Bridport, (12)345, 10345, A. Belt.

Isle of Wight—Bembridge, (12)345, July 1887 ! T. F. Burrows.

Hants. S.—Not uncommon, Christchurch, June 1885 ! C. Ashford. Selborne, 12345, Aug. 1895 ! S. C. Clapham. Romsey, 12345, July 1891 ! Rev. W. L. W. Eyre.

Hants. N.—Hartley Maudit near Alton, 12345, Aug. 1895, S. C. Clapham.

Sussex W.—Worthing, 1886, B. M. Oakeshott. Lewes ! T. Stanton Hillman.

Kent E.—Canterbury, Oct. 1901, C. E. Wright.

Kent W.—Bickley, May 1884 ! T. D. A. Cockerell. Swanley, Rev. J. W. Horsley.
Maidstone, H. Elgar and H. Lamb.

Surrey—Guildford, Aug. 1884; and Caterham, April 1884, T. D. A. Cockerell.
Shere, 12300, June 1886 ! G. T. Rope. Grayswood, E. W. Swanton.

Essex N.—Saffron Walden, J. H. Ashford. Dovercourt, Sep. 1909, C. E. Wright.
Colchester, J. Kidson Taylor.

Middlesex—Ealing, with yellow ground colour, 12345, (123)(45), 1(23)(45), 10345, 00300, 02300, 12300; with red ground, 00300, 02300, 12340, 12(34)5, 00345, 00340; and with yellow ground, 00300. Hanwell, A. Belt.

Herts.—Sandridge, Aug. 1883, A. F. Griffith.

Berks.—Maidenhead, July 1884, T. D. A. Cockerell. Bracknell, Aug. 1868, Chas. Ashford.

Suffolk E.—Blaxhall, (12)345 and 12345, June 1885 ! G. T. Rope. Mendlesham and Needham Market. A. Mayfield.

Suffolk W.—Sudbury, E. Ransom.

Norfolk E.—Catton, 12345, Kirby Bedon and Bramerton, A. Mayfield. Yelverton, Rev. S. Spencer Pearce.

Bedford—Amphthill, June 1883, C. Ashford.

Northampton—Eye, Aug. 1882 ! T. W. Bell. Lime quarries, Blisworth, Sept. 1893, L. E. Adams. Northampton road, Kettering, July 1895; and Middleton, Aug. 1898, C. E. Wright. Hunsbury Hill, Northampton, W. H. Hollis.

Gloucester E. — Gloucester, 12345, July 1885 ! Rev. H. Milnes. Cheltenham, 1854, W. Webster.

Hereford—Hinderton, 00340 and 00300, White Cross, Hereford (Boycott and
Bowell, Contr. Fauna of Hereford, Oct. 1899, p. 67).

Worcester—Sub-var. *albina-fasciata*, Dunley, and garden in Jenny Hole, Stourport (Williams, Journ. of Conch., 1889, p. 112).

Glamorgan—Cogan near Cardiff, April 1887, F. W. Wotton. Swansea, Sept. 1905 ! H. Rowland Wakefield.

Pembroke—Tenby, Oct. 1887, C. Jefferys.

Lincoln S. — Very rare, Sapperton, 12345, 1(23)(45), and 023(45), Rev. E. A. Woodruffe-Peacock.

Rutland - Morcott, 12345 and (12)345, E. Collier.

Derby—Matlock, 123(45), 00340, and 00300, J. A. Howe. Mappleton, J. D. Dean.

Lancashire S.—Whalley, 12345, R. Wigglesworth.

York N.E.—Scarborough, W. Bean. Ruston, Cayton Bay, Gristhorpe, Scalby road, and Castle Hill, Scarborough, J. A. Hargreaves. Has become much commoner in the district (W. Gygell, Sci. Goss., 1901). Hedges near Thirsk ! T. Pratt. North Cheek, Robin Hood's Bay, June 1888 ! W. Denison Roebuck.

York Mid W.—Otley, 1886, J. A. Hargreaves. Hawksworth, 1889, F. Rhodes. Thorparch, 1880, C. Smethurst. Collingham and near Aberford, Sept. 1894, A. Hartley and F. Booth.

Durham—Durham, 12345, July 1885 ! Baker Hudson.

Cheviotland—Alnmouth, (123)(45), 123(45), (12)3(45), Rev. Dr. McMurtrie.

Westmorland and Lake Lancs.—Holme Island, Grange, Aug. 1906, H. Beeston.
SCOTLAND.

Haddington—Very rare, North Berwick, Rev. Dr. McMurtrie.

Aberdeen S.—Abundant on the sandhills near Black Dog Farm, Belhelvie (J. Macgillivray, Moll. Aberdeen, 1843, p. 84), and still found plentiful there by Mr. F. Booth in Aug. 1910 !

IRELAND.

Wicklow—Greystones, 12345, 00300 ! R. F. Scharff.

Limerick—Abundant on blackberry and sloe bushes near Limerick, H. Fogerty.

FOREIGN DISTRIBUTION.

Germany—Moquin-Tandon cites it from Metz, Lorraine; Dr. Weinland from Suabia; Dr. Merkel from Setzdorf and Melling, Silesia; Dr. Kuster from Bamberg, Franconia; and Dr. Scharff has found it at Frankfort, Nassau.

France—Recorded from Beauvais, Oise, July 1888 ! S. C. Cockerell. Moquin-Tandon reports it from Valenciennes, Nord; Grenoble, Isère; Creil, Oise; Soréze, Tarn; and Lyons, Rhône; M. Locard cites it from several localities in the Ain; and from Lagny, Seine-et-Marne; M. Pascal from Cussac, Haute Loire; M. Charpy from St. Amour, Jura; Dr. Gassies from Nerac, Lot-et-Garonne; and Bouchard-Chantreaux the variety with white and rosy-ground tints from Pas-de-Calais.

Belgium—Not rare on gooseberry bushes, Dinant, Namur; Arlon, Luxemburg; and other places, Jules Colbeau. Common at Hastière, Namur, Van den Broeck. Near Brussels, formulae 1(2345) and (12)(345), M. Timmermanns.

Switzerland—Recorded from St. Gall by Dr. Hartmann.

Russia—Aland Isles (Luther, Land Sottv. Gastrop. Finland, 1901, p. 72).

Norway—Ekeborg near Christiania, Westerlund (Exp. Crit., 1871, p. 40). Var. *albidu* (transparent bands) with formula 12345, from Christiania, Ringerige, Jarlsberg, Laurvik, Brevik, and Lillesand; the formula (12)345 is found at Christiania, and 00345 at Laurvik (Esmark, Journ. of Conch., 1886, p. 109).

Sweden—Ignaberga, Skane; Ostergotland; Nerike; and near Stockholm (Westerlund, l.c.).

Canada—In Labrador, Lady Douglas found the formula 10345, and presented the specimens to the British Museum.

On Grand Entry, Magdalen Islands, the formula 00300 is recorded as not rare by Mr. G. H. Clapp.

United States—From Massachusetts this variety is recorded from Sciasconset, Nantucket Island, by Dr. Pilsbry; with formula 12345 from Magnolia, by Prof. Cockerell; and the following are reported from Rockport by Mr. G. H. Clapp: 12345, 10345, 12300, 00340, 00340, and 00300.

From Maine Dr. J. W. Mighels records it as found by Capt. Walden on a little island in Casco Bay; and Prof. Packard collected specimens on Brown Cow Island in the same bay. The formula 00300 is reported from Bar Island and Bar Harbour by Mr. G. H. Clapp.

VARIATIONS IN COLOUR OF LIP OF PERISTOME.

The colour of the lip varies from white, through many gradations and shades to dark brown and even black, but all the darker shades are very unstable,¹ and fade rapidly soon after the death of the animal.

Var. *luteolabiata* Cockerell.

Helix hortensis var. *luteolabiata* Cockerell, Science Gossip, 1887, p. 67.

SHELL with the lip of a decided yellow.

ENGLAND.

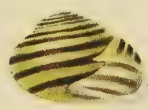
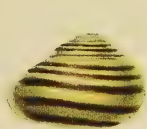
Devon N.—Ilfracombe, rare, Aug. 1903 (Beeston and Wright, l.c.).

Cornwall W.—Truro, Aug. 1886, J. H. James.

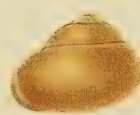
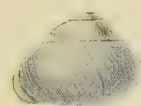
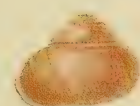
Dorset—Bridport, 12345, Sept. 1898, C. E. Wright.

Hants. S.—A specimen with ground colour of shell and lip of a salmon tint, Christchurch, July 1897, C. E. Wright.

HELIX HORTENSIS Müller.



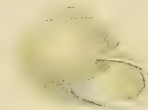
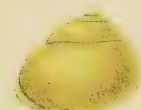
Helix hortensis Müller.
Fordingbridge, Hampshire, H. Richardson.



H. hortensis v. *incarnata* Pic.
Bickley, T. D. A. Cockerell.

H. hortensis v. *lilacina* Taylor.
Chislehurst, S. C. Cockerell.

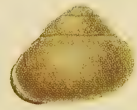
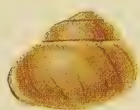
H. hortensis v. *fagorum* Weinl.
Württemberg.



H. hortensis v. *flavovirens* Pic.
Folkestone, Mrs. Fitzgerald.

H. hortensis v. *lutea* Pic.
Collingham, Yorks.

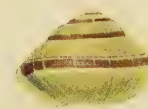
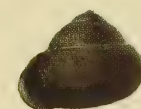
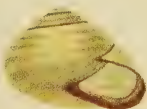
H. hortensis v. *subalbida* Loc.
Bitton, Miss F. M. Hele.



H. hortensis v. *fusca* Poiret.
Westphalia, H. Richardson.

H. hortensis v. *olivacea* Taylor.
St. Mary's, York.

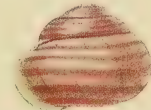
H. hortensis v. *griseobrunnea* Esm.
St. Mary's, York.



H. hortensis v. *fuscolabris* Kregl.
Christchurch, C. Ashford.

H. hortensis v. *decorti* Schleich.
Marnhull, E. W. Swanton.

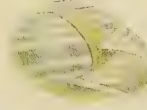
H. hortensis v. *fasciata* Taylor.
Blagdon, Miss F. M. Hele.



H. hortensis v. *rufozonata* Ckll.
Torquay, F. W. Wotton.

H. hortensis v. *citrinizonata* Taylor.
Llandudno, W. D. Roebuck.

H. hortensis v. *roseozonata* Ckll.
Sutton, F. H. Sikes.



H. hortensis v. *violaceozonata* Taylor.
Barnsley, W. E. Brady.

H. hortensis v. *arenicola* Macg.
Much Marcle, Hereford, E. Collier.

H. hortensis v. *lurida* Moq.
Folkestone, Miss F. M. Hele.

Sussex E.—Hastings, Aug. 1900, C. E. Wright.

Sussex W.—Lavant, Sept. 1901, C. E. Wright.

Kent W.—Shepherdswell, Aug. 1896, C. E. Wright.

Northampton—Limestone quarry, Blisworth, Oct. 1894 ! L. E. Adams. Roade, Oct. 1899 : and Weldon, May 1904, C. E. Wright. Hunsbury Hill, Northampton, W. H. Hollis.

SCOTLAND.

Forfar—Montrose, July 1886 ! W. Duncan.

Var. *roseolabiata* Taylor.

Helix hortensis var. *nebulosa* Menke, Syn. Moll., 1830.

Helix hortensis var. *roseolabiata* Taylor, Journ. of Conch., 1883, iv., p. 34.

SHELL with a pink or rose-coloured aperture.

ENGLAND AND WALES.

Cornwall W.—Truro, var. *lutea* (12)3(45) ! J. H. James.

Devon S.—Exeter ! E. Parfitt. Common, Topsham, Aug. 1892, L. E. Adams.

Devon N.—Ilfracombe, very rare, Aug. 1903 (Beeston and Wright, l.c.). Morte-hoe, Mrs. G. B. Longstaff.

Somerset N.—Bladon and Bitton near Bath, June 1877 ! Miss F. M. Hele. Well distributed, Bratton St. Maur, E. W. Swanton.

Wilts. S.—Var. *lutea*, 12345 and (12)345, in a pine-wood near Stonehenge, July 1886, Rev. R. W. J. Smart. Stourton and Mere, E. W. Swanton.

Dorset—Lulworth, Aug. 1884, S. C. Cockerell. Rodwell near Weymouth, 1885, R. Damon. Charminster, var. *lutea* (12345) and (123)45, July 1889 ! T. F. Burrows. Chideock near Bridport, var. *lutea* 123(45), A. Belt. Swanage, July 1891, Rev. W. L. W. Eyre.

Hants. S.—Winchester, Aug. 1884, Sydney C. Cockerell.

Hants. N.—Swarraton, var. *lutea* (12345), June 1888 ! Rev. W. L. W. Eyre.

Sussex W.—Worthing, 1883, B. M. Oakeshott.

Kent E.—Faversham, Aspringe, and Ashford, July 1877, Miss Fairbrass.

Kent W.—Mereworth, 12345, and sub-var. *lutescens* (123)45, Chislehurst and Bickley, T. D. A. Cockerell. Swanley, Rev. J. W. Horsley. Charing, July 1896, C. E. Wright.

Surrey—Waringham, Sept. 1883, T. D. A. Cockerell. Shere, var. *lutea* 12345, June 1886 ! G. T. Rope. Haslemere and Croydon (C. Pannell, jr., Journ. of Conch., 1902, p. 172).

Essex N.—Colchester, Aug. 1896, C. E. Wright. Wimbish, Bardfield, Saffron Walden, Chelmsford, Radwinter, etc., R. Miller Christy.

Middlesex—Pinner, 1842, Thomas Glover.

Berks.—Moderately common, Maidenhead, 1880, L. E. Adams.

Norfolk E.—Catton near Norwich, 1886, T. Reeve.

Bedford—Amphill, Charles Ashford.

Hunts.—Great Raveley, Oct. 1909, C. E. Wright.

Northampton—Limestone quarry, Blisworth, Oct. 1894, L. E. Adams. Swarming in hedgerow, Warkton, May 1895 ; Stamford road, Kettering, July 1896 ; and Rothwell, Sept. 1891, C. E. Wright. Northampton, W. H. Hollis.

Gloucester W.—Selsley Hill, Aug. 1884 ! E. J. Elliott.

Pembroke—Gumfreston near Tenby, Oct. 1887, C. Jefferys.

Notts.—Bulwell, 1866, and near Highfield House, Beeston, 1853, E. J. Lowe. Plentiful at Wollaton, and in a lane at Basford, 1879, E. J. Lowe and C. T. Musson.

Derby—Matlock, H. E. Craven.

Lancashire S.—Burnley, Aug. 1887, J. Russell Wildman.

Lancashire Mid—Star-Hills near Lytham, 1853, E. J. Lowe.

York S.E.—Fulford, near York, 1881, R. Miller Christy.

York N.E.—Scarborough, 1884, Chas. Ashford. Skelton Lane and Clifton near York, 1881, R. Miller Christy.

York S.W.—Lofthouse, G. Roberts.

York Mid W.—Capt. Brown in 1844 recorded it as found by a Mr. Leyland, on the canal banks between Bingley and Keighley, but confined to a small area. Collingham, Sept. 1908 ! Alf. Hartley. Knaresborough, Goldsborough, Harrogate Starbeck, and Ripon, H. F. Fitzgerald. Hobmoor, 1881, R. Miller Christy.

Durham—Local, near Shincliff Bridge, Durham, 1884 ! Baker Hudson.

Cheviotland—Alnmouth, Sept. 1888, Rev. Dr. McMurtrie.

Cumberland—Corby, Sept. 1909, Mrs. G. B. Longstaff.

SCOTLAND.

Haddington—Dunbar ! Baker Hudson.

Edinburgh—Cramond Isle, Sept. 1888 ! T. Scott.

Perth N.—Kinnoul Hill near Perth, 1885, H. Coates.

Forfar—Montrose, July 1884 ! W. Duncan. Arbroath, Aug. 1884 ! A. Somerville.

Dumbarton—Scarce at Luss, April 1882, Alfred Brown.

IRELAND.

Wicklow—Enniskerry, Aug. 1904, P. H. Grierson.

FOREIGN DISTRIBUTION.

Germany—Cited by Meyer for Metz, Lorraine ; and by Merkel for Agnetendorf, Silesia.

France—Recorded by Locard from Lagny, Seine et Marne ; by Bouchard-Chantreaux from Pas-de-Calais ; by Fischer from Mont Dore, Puy-de-Dôme ; and by Desmoulins from the Gironde.

Norway—Recorded by Miss Esmark from Jarlsberg and Langesund.

Sweden—Recorded by Lindström from the Island of Gothland.

Var. *violaceolabiata* Taylor, var. nov.

SHELL with a purple or lilac lip.

ENGLAND.

Cornwall W.—Truro, 1886 ! J. H. James.

Somerset N.—Blagdon near Bristol, Aug. 1883 ! R. M. Christy.

Northampton—Kettering ! C. E. Wright.

CONTINENTAL DISTRIBUTION.

Germany—Recorded from Bauersberg, Silesia, and Rhön, Thuringia, by Prof. Sandberger ; and by Dr. Reinhardt from Kozen.

France—Recorded by Desmoulins from the Gironde ; by Locard from Lagny, Seine-et-Marne ; by Dr. Bandon from Mouy, Oise ; and by Dr. P. Fischer from the Puy-de-Dôme at the Grand Cascade, and other places in the Valley of Mont Dore.

Var. *fuscolabris* Kreglinger.

Helix hortensis var. *fuscolabris* Kreglinger, Syst. Verz., 1870, p. 196.

Helix hortensis var. *apertura-fuscescente* Picard, Moll. Somme, 1840, p. 215.

Helix sauveuri Colbeau, Ann. Soc. Mal. Belg., 1865, p. 32.

SHELL with a brown aperture or lip.

The sub-var. *apertura-fuscescente* is described as with an aperture pale-brown to horny ; when the lip is brown the penultimate whorl is also tinged with the same colour.

The sub-var. *sauveuri* is described as possessing a violaceous-brown peristome, with a white or paler rib, and a pale brownish stain on the penultimate whorl. The shell is usually reddish and without bands.

ENGLAND.

Somerset N.—Bratton St. Maur, well distributed, E. W. Swanton.

Devon S.—Near Exeter (E. Parfitt, Nat., 1854, p. 151). Exmouth, 1902 ! F. H. Sikes.

Devon N.—Braunton Burrows, Aug. 1903 (Beeston and Wright, l.c.).

Somerset S.—Ilminster, Sept. 1892 ! Rev. W. L. W. Eyre.

Wilts. N.—Great Bedwyn (Townsend), E. W. Swanton.

Wilts. S.—Edington, E. W. Swanton.

Dorset—Stour Provost, May 1906, Rev. W. A. Shaw.

Isle of Wight—Bembridge, 1888, T. F. Burrows.

Hants. S.—Christchurch, June 1884, C. Ashford. Hayling, June 1896 ; and Ringwood, Aug. 1906, C. E. Wright. Romsey ! Rev. W. L. W. Eyre.

Sussex W.—Ratham near Chichester, June 1883 ! W. Jeffery.

Sussex E.—West Blatchington, Aug. 1883 ! R. Miller Christy.

Kent E.—Folkestone ! Mrs. Fitzgerald.

Essex N.—Chelmsford, R. Miller Christy.

Middlesex—Pinner, 1842, Thos. Glover.

Oxford—A few near Watlington Church in 1853, Rev. Dr. Norman.

Bucks.—Wendover, Aug. 1909 ! C. Oldham.

- Norfolk E.**—Common but local by New Catton Church, 1845, J. B. Bridgman.
Alpington, Rev. S. Spencer Pearce. Brooke, A. Mayfield.
Cambridge—Cambridge, June 1877 ! B. Holgate.
Northampton—Dogthorpe near Peterborough, T. W. Bell.
Salop—Meole Brace Hall, Sept. 1908, J. Cosmo Melvill.
Lincoln N.—Luddington, July 1906 ! J. F. Musham.
Derby—Repton, J. Hagger ; Winster, Rev. H. Milnes ; Matlock, J. A. Howe.
York Mid W.—Tadcaster, Sept. 1877 ! H. Crowther.
York S.E.—Driffild, 1883 ! L. B. Ross.
York S.W.—Kexborough, Sept. 1910 ! W. E. Brady. Lofthouse, G. Roberts.
York N.W.—Coverdale, 1887, R. C. Chaytor.
Northumberland S.—Recorded by Mr. Alder from Stella, near Newcastle, as
 “a curious pale brown variety with lip of a paler shade of the same colour.”

SCOTLAND.

- Perth Mid**—Balgowan near Perth, 1884 ! H. Coates.
Elgin—Burghead (Rev. G. Gordon, Zool., 1854, p. 4455).

CONTINENTAL DISTRIBUTION.

Germany—Recorded by Rossmässler from Tharand, Saxony ; by Dr. Weinland from Schönthal, Wurtemberg ; by Herr Schmidt from Saxony and Westphalia ; by Meyer from Metz in Lorraine ; by Merkel from Agnetendorf, Silesia ; reported from Charlottenburg near Berlin by J. H. Ponsonby ; and collected by Prof. A. Denny on the slopes of the Drachenfels in Rhenish Prussia.

France—Recorded by Mr. S. C. Cockerell from Veules, Seine Inférieure ; by Mr. F. H. Sikes from Granville, Manche ; by Mr. E. Collier from Bief du Fourg, Jura, and Vernaison, Rhône ; by Bonillet from Mont Dore, Puy-de-Dôme ; and by Bouchard-Chantereaux from Pas-de-Calais. The sub-var. *apertura-fuscescente* is described from specimens found in the department of the Somme by Picard.

Belgium—Sub-var. *sauvauri* is recorded by M. Colbeau from Furnes, West Flanders ; Soignies in Hainault ; Trooz, Chaudfontaine, Theux, Spa, and Aywaille, Liège ; Arlon, Luxemburg ; and Rochefort, Namur.

Spain—Hoy de Barcena, Santander, Old Castile, May 1860, E. J. Lowe.

Austro-Hungary—Recorded by Herr Slavik from a churchyard wall near Böhmisch-Leipa in Bohemia.

Norway—Recorded by Miss Esmark from Lillesand, Fredriksvaern and Bergen.

Var. **nigrolabiata** Taylor, var. nov.

SHELL with a black lip or peristome.

ENGLAND.

Sussex W.—Ratham, near Chichester, pure yellow unbanded shells, strictly localized and occurring with var. *fuscolabiata*, June 1883, W. Jeffery.

SCOTLAND.

Forfar—Montrose, July 1884 ! W. Duncan.

CONTINENTAL DISTRIBUTION.

Germany—Dr. E. von Martens records a specimen from Gottingen, Hanover, which he described as “*labro nigro-fusca*.”

France—M. Locard records that M. Terver found the variety with black lip at Vernay, Rhône ; Contagne records a var. *melanostoma* from Orsay, Seine-et-Oise ; and Ray and Dronet describe a variety with blackish aperture as frequent in Champagné Méridionale.

Var. **bimarginata** Taylor, var. nov.

SHELL with a coloured outer lip, bordered internally by a white rib.

ENGLAND.

Sussex W.—Erringham, Aug. 1883 ! R. Miller Christy.

York Mid W.—Specimens with outer lip rose coloured, Pateley Bridge, April 1883 ! W. Storey.

MONSTROSITIES.

This section includes all irregularly grown and anomalous shells, and probably includes the var. *marginella* of Westerlund (Moll. Extram. Syn., 1877, p. 58), which appears to be characterized by a peculiar sulcus or grooving of the outer lip, and is recorded from Kalmar and Oviken in Sweden.

Monst. *scalare* Férussac.

Helix hortensis monst. *scalaris* Férussac, Tabl. Syst., 1822, p. 35 pl. 36. ff. 11, 12.

SHELL with elevated spire and partially dislocated whorls.

ENGLAND.

Devon S.—Var. *lutea*, 00000, Topsham, June 1890, E. Collier.

Oxford—Near Oxford, H. C. Napier.

Northampton—Northampton road, Kettering, July 1895; and Rothwell, Sept. 1891! C. E. Wright.

York S.E.—Carnaby, Rev. W. C. Hey.

York N.E.—A specimen from Ayton, collected by J. Ross, in the Alder Collection, Newcastle Museum.

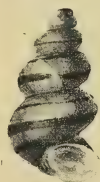


FIG. 402.—*H. hortensis* m. *scalare* Férussac.
Rothwell, Northants.
(Mr. C. E. Wright).

CONTINENTAL DISTRIBUTION.

Germany—Monst. *scalare* is reported from Metz, Lorraine, by Joba.

France—Monst. *scalare* has been recorded by Bouillet from Montferrand, Puy-de-Dôme; by Barbie from Dijon, Côte d'Or; by Jeannot from Avesnes, Nord; by Demarle from Boulogne-sur-Mer, Pas-de-Calais; by Thomas from Nantes, Loire Inférieure; and by Grateloup from Montpellier, Hérault, and the Gironde.

Dr. Baudon chronicles m. *scalaroides* from Mesnil St. Firmin, Oise.

Belgium—Reported by M. Sizaïre from Spontin, Namur; and by M. Roffiaen from Tervueren, Brabant.

Switzerland—M. Charpentier records a specimen found by M. Studer near Berne.

Monst. *sinistrorsum* Férussac.

Helix hortensis monst. *sinistrorsa* Férussac, Tabl. Syst., 1822, p. 35.

Helix nemoralis v. minor c. *contraria* Charpentier, Moll. Suisse, 1837, p. 7.

Helix hortensis monst. *sinistrorsum* Taylor, Journ. of Conch., 1883, p. 35.

SHELL reversed or sinistral in coiling.

ENGLAND AND WALES.

Devon S.—Var. *lutea*, 00000, Topsham, June 1890, E. Collier.

Somerset N.—Var. *lutea*, 00000, one at Keynsham, April 1874, and one at Coombe Dingle, May 1875, Miss Hele.

Northampton—Var. *arenicola*, 123(45), Northampton road, Kettering, July 1895, C. E. Wright.

Gloucester W.—Horfield, Aug. 1887, Miss Hele.

Pembroke—Var. *lutea*, 00000, Tenby, July 1886, C. Jefferys.

Lancashire S.—Burnley, Aug. 1887, J. Russell Wildman.

York Mid W.—Var. *lutea*, 00000, near York, May 1894, J. Hawkins.

SCOTLAND.

Aberdeen S.—Links near Aberdeen, 1871, Prof. J. W. H. Traill.

FOREIGN DISTRIBUTION.

France—Recorded by Dr. Grateloup from Montpellier, Hérault, and Avesnes in the Nord; and by Mr. J. R. le B. Tomlin from the sand-dunes of Brittany.

Switzerland—Var. *contraria* recorded by M. Charpentier as found by M. Studer.

United States—Dr. J. W. Mighels recorded in 1843 the finding by Capt. Walden of a heterostrophe var. *arenicola* on a little island in Casco Bay, Maine.

Geographical Distribution.—*Helix hortensis* is one of our most highly organized species and scarcely inferior to its close ally, *H. nemoralis*. Its probable earlier advent and more primitive organization is shown not only by its more extensive northern and north-western range and its somewhat more local or discontinuous distribution, but by the somewhat sacculate structure of the vaginal mucus glands, recalling that characteristic feature of the more ancient *Belogona Euadenia*.¹ The gypsobelum or love-dart, however, exhibits a considerable and remarkable complexity, closely resembling that of *Euparypha pisana*, and quite different in character from that of *H. nemoralis*, which has its relationship with that of *H. aspersa*, from which it is scarcely distinguishable, except by its size.

Helix hortensis has probably arisen within the north-westerly part of the Germanic region, and has diffused itself chiefly to the north-west, spreading to the Faroes, Iceland, and even to North America; its extension in other directions being comparatively limited, probably owing to the keener competition encountered from the highly organized prior occupants of the territory.



FIG. 403.—Holartic Distribution of *Helix hortensis* Müller.

- Recorded Distribution in the Nearctic and Western Palearctic regions.
- Supposed Distribution of Land areas in Tertiary times, based on the present shallower ocean areas, and showing the hypothetical land-bridge connecting Europe with America.
- Present Distribution of Land areas.

The presence of *H. hortensis* in North America is somewhat perplexing, and has led to much speculation and diversity of opinion as to its claim to be regarded as a true native of that country, or whether it owes its presence there to the voluntary or involuntary agency of man, as it is a species which has extended its range very far beyond that of its immediate European allies, from which it is now completely isolated geographically ;

in its organization it is also quite different from and immensely superior to the *Protogona*,¹ the general helicidian type characteristic of Eastern North America, which, according to Dr. Pilsbry, has a very simple and primitive structure; yet the distributional area of *H. hortensis*, extending as it does along more than a thousand miles of coast and its occupancy of numerous rocky islets uninhabitable by man, combined with the discovery of its presence in the Pleistocene clays of Maine, lend support to the view that it has reached that country through natural diffusion, by means of the land-bridge, believed by many to have connected North-western Europe with North America during Tertiary times, and by means of which a few other terrestrial species of boreal distribution have probably also reached Eastern North America.

On the European continent it is said to be more or less completely diffused in France, Germany, Netherlands, Switzerland, Austro-Hungary, Denmark, Russia, Italy, Spain, Scandinavia, and Balkan Peninsula, but unfortunately implicit reliance cannot be placed on the correct specific allocation of all the records of this or the preceding species.

It is recorded by M. Locard as inhabiting the Amoor Valley in Manchuria, but there seem no grounds for believing that it naturally inhabits any part of the Manchurian or other East Asiatic region.

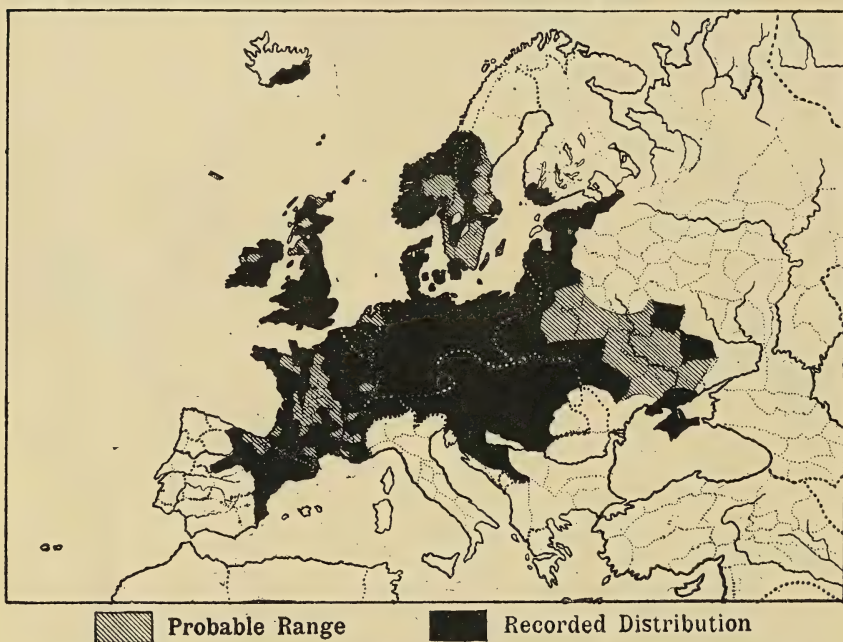


FIG. 404.—Geographical Distribution of *Helix hortensis* Müller in the Palearctic region.

In the British Isles it is distributed throughout Great Britain, becoming in suitable districts increasingly more numerous and generally diffused towards the north. In Ireland, though probably existing throughout the country, it is said to display little variation in the north, and to be most plentiful and variable in the more southerly districts, and along the

¹ Monog. i., p. 394, f. 725.

Distribution of *Helix hortensis* Müller

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

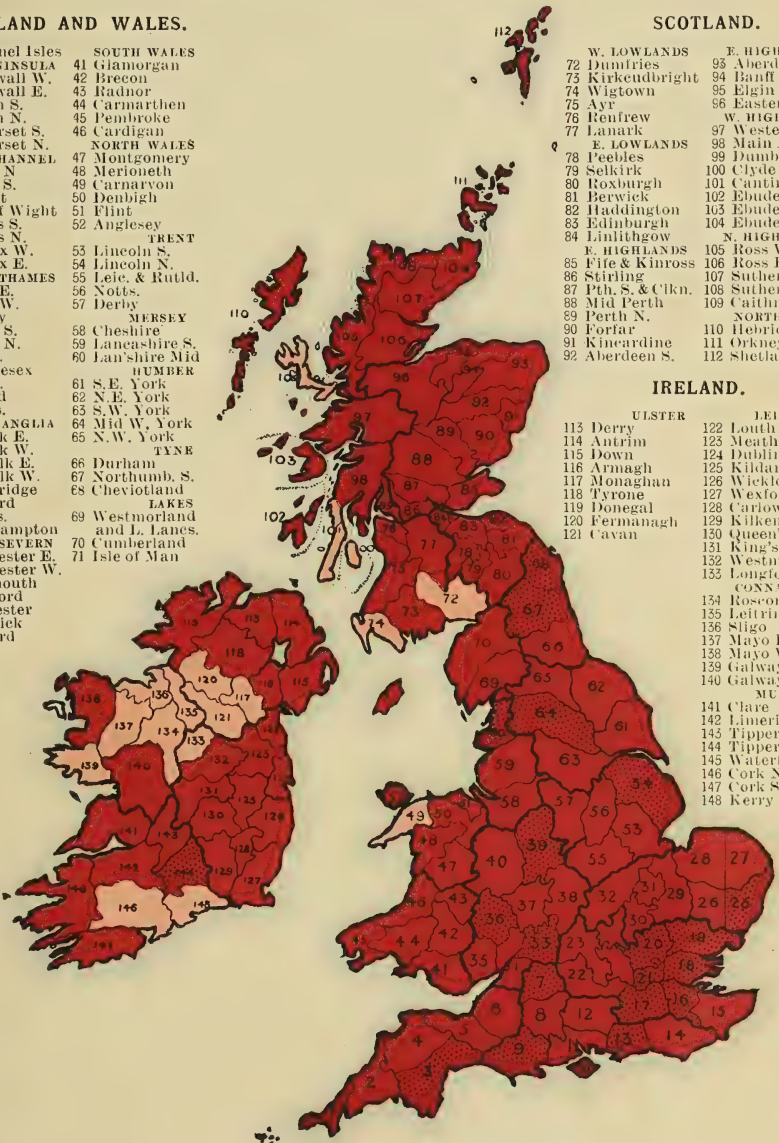
- | | |
|------------------|-------------------|
| Channel Isles | SOUTH WALES |
| PENINSULA | 41 Glamorgan |
| 1 Cornwall W. | 42 Brecon |
| 2 Cornwall E. | 43 Radnor |
| 3 Devon S. | 44 Carmarthen |
| 4 Devon N. | 45 Pembroke |
| 5 Somerset S. | 46 Cardigan |
| 6 Somerset N. | NORTH WALES |
| CHANNEL | 47 Montgomery |
| 7 Wilts N. | 48 Merioneth |
| 8 Wilts S. | 49 Carnarvon |
| 9 Dorset | 50 Denbigh |
| 10 Isle of Wight | 51 Flint |
| 11 Hants S. | 52 Anglesey |
| 12 Hants N. | TYNNE |
| 13 Sussex W. | 53 Lincoln S. |
| 14 Sussex E. | 54 Lincoln N. |
| THAMES | 55 Leic. & Rutld. |
| 15 Kent E. | 56 Notts. |
| 16 Kent W. | 57 Derby |
| 17 Surrey | MERSEY |
| 18 Essex S. | 58 Cheshire |
| 19 Essex N. | 59 Lancashire S. |
| 20 Herts. | 60 Lancashire Mid |
| 21 Middlesex | HUMBER |
| 22 Berks. | 61 S.E. York |
| 23 Oxford | 62 N.E. York |
| 24 Bucks. | 63 S.W. York |
| ANGLIA | 64 Mid W. York |
| 25 Suffolk E. | 65 N.W. York |
| 26 Suffolk W. | TYNE |
| 27 Norfolk E. | 66 Durham |
| 28 Norfolk W. | 67 Northumb. S. |
| 29 Cambridg | 68 Cheviotland |
| 30 Bedford | LAKES |
| 31 Hunts. | 69 Westmorland |
| 32 Northampton | and L. Lanes. |
| SEVERN | 70 Cumberland |
| 33 Gloucester E. | 71 Isle of Man |
| 34 Gloucester W. | |
| 35 Monmouth | |
| 36 Hereford | |
| 37 Worcester | |
| 38 Warwick | |
| 39 Stafford | |
| 40 Salop | |

SCOTLAND.

- | | |
|--------------------|-------------------|
| W. LOWLANDS | E. HIGHLANDS |
| 72 Dumfries | 93 Aberdeen N. |
| 73 Kirkcudbright | 94 Banff |
| 74 Wigtown | 95 Elgin |
| 75 Ayr | 96 Easternness |
| 76 Renfrew | W. HIGHLANDS |
| 77 Lanark | 97 Westernness |
| E. LOWLANDS | 98 Main Argyle |
| 78 Peebles | 99 Dumbarton |
| 79 Selkirk | 100 Clyde Isles |
| 80 Roxburgh | 101 Cantire |
| 81 Berwick | 102 Ebudes S. |
| 82 Haddington | 103 Ebudes Mid |
| 83 Edinburgh | 104 Ebudes N. |
| 84 Linlithgow | N. HIGHLANDS |
| 85 Fife & Kinross | 105 Ross W. |
| 86 Stirling | 106 Ross E. |
| 87 Pth. S. & Clkn. | 107 Sutherland E. |
| 88 Mid Perth | 108 Sutherland W. |
| 89 Perth N. | 109 Caithness |
| 90 Forfar | 110 Hebrides |
| 91 Kincardine | 111 Orkneys |
| 92 Aberdeen S. | 112 Shetlands |

IRELAND.

- | | |
|---------------|------------------|
| ULSTER | LEINSTER |
| 113 Derry | 122 Louth |
| 114 Antrim | 123 Meath |
| 115 Down | 124 Dublin |
| 116 Armagh | 125 Kildare |
| 117 Monaghan | 126 Wicklow |
| 118 Tyrone | 127 Wexford |
| 119 Donegal | 128 Carlow |
| 120 Fermanagh | 129 Kilkenny |
| 121 Cavan | 130 Queen's Co. |
| | 131 King's Co. |
| | 132 Westmeath |
| | 133 Longford |
| | CONNUGHT |
| | 134 Roscommon |
| | 135 Leitrim |
| | 136 Sligo |
| | 137 Mayo E. |
| | 138 Mayo W. |
| | 139 Galway W. |
| | 140 Galway E. |
| | MUNSTER |
| | 141 Clare |
| | 142 Limerick |
| | 143 Tipperary N. |
| | 144 Tipperary S. |
| | 145 Waterford |
| | 146 Cork N. |
| | 147 Cork S. |
| | 148 Kerry |



- Probable Range.
- Recorded Distribution.
- Distribution verified by the Author.
- Geological Distribution.

Helix hortensis Müll.

The **five-banded** group contains sixteen varieties :

1 2 3 4 5	(123)45	(12)(345)	1(23)45
(12345)	(123)(45)	(12)(34)5	1(23)(45)
(1234)5	12(345)	(12)3(45)	12(34)5
1(2345)	(12)345	1(234)5	123(45)

The **four-banded** section embraces twenty-eight different forms:

1 2 3 4 0	12(34)0	120(45)	0(2345)
(1234)0	1 2 3 0 5	(12)0(45)	0(234)5
(123)40	(123)05	1 0 3 4 5	0(23)(45)
(12)(34)0	(12)305	10(345)	0(23)45
(12)340	1(23)05	10(34)5	02(345)
1(234)0	1 2 0 4 5	103(45)	02(34)5
1(23)40	(12)045	0 2 3 4 5	023(45)

The **three-banded** forms are twenty-five in number :

1 2 3 0 0	(12)005	0(234)0	0 2 3 0 5
(123)00	1 0 3 0 5	0(23)40	0(23)05
(12)300	1 0 3 4 0	02(34)0	0 2 0 4 5
1(23)00	10(34)0	0 0 3 4 5	020(45)
1 2 0 4 0	1 0 0 4 5	00(345)	
(12)040	100(45)	00(34)5	
1 2 0 0 5	0 2 3 4 0	003(45)	

The **two-banded** varieties are fourteen in number :

1 2 0 0 0	0 0 3 4 0	1 0 3 0 0	0 2 0 0 5
(12)000	00(34)0	1 0 0 4 0	0 0 3 0 5
0 2 3 0 0	0 0 0 4 5	1 0 0 0 5	
0(23)00	000(45)	0 2 0 4 0	

The **one-banded** form exists in five varieties only :

1 0 0 0 0	0 0 3 0 0	0 0 0 0 5
0 2 0 0 0	0 0 0 4 0	0 0 0 0 0

You will greatly oblige by marking such band formulæ of this species, as you may possess or know to exist, and return the sheet at your convenience to

JNO. W. TAYLOR, NORTH-GRANGE, HORSFORTH.

eastern margin of the great limestone tract; but although reaching the extreme western limits of the island, there are very many districts from which it has never been reported.

Many of the older Irish records of this species are, however, regarded by some experienced Irish conchologists as more properly referable to *Helix nemoralis* var. *albolabiata*, and this belief is undoubtedly correct in certain cases, as that form is prevalent in some parts of Ireland, and scarcely distinguishable from *H. hortensis* except by examination of the gypsobelum.

The known distribution of this species in Ireland being so incomplete, a detailed list of records is given.

IRELAND.

ULSTER.

Derry—Downhill, A. W. Stelfox.

Antrim—Slenish Mountain and on the banks of the river, R. Welch. Recorded for Portrush in 1840 by Mr. W. Thompson; and specimens are in the Belfast Museum, labelled "Cave Hill, Belfast."

Down—Cathedral graveyard, Downpatrick, R. Welch. Mahee Island, Strangford Lough, J. N. Milne. Recorded in 1840 by Mr. W. Thompson from Moira and Newcastle.

Armagh—Armagh, Dec. 1904 ! P. H. Grierson.

Tyrone—Newtownstewart, R. Welch.

Donegal—Portsalon, very local ! R. Standen. Dunfanaghy, A. W. Stelfox.

LEINSTER.

Louth—Common about Ardee, April 1905 ! P. H. Grierson.

Meath—Graveyards at Kells and Ardracran, R. Welch. Longwood and Ballivor, March 1905 ! Athboy and Summerhill, Nov. 1905 ! Moynalty and Nobber, 1907 ! P. H. Grierson.

Dublin—Glen Druid, Carrickmines, Oct. 1886 ! W. F. de Vismes Kane. Blind lane, Cabragh old road, April 1886 ! and lane by Finglas quarry near Dublin, Aug. 1886 ! J. R. Redding. Phoenix Park and Glasnevin Cemetery, Dublin, 1889, E. R. Waite. Cabra, Aug. 1905 ! P. H. Grierson. Woods in Lucan demesne, 1909, R. A. Phillips. Recorded by Mr. W. Thompson in 1840 from the neighbourhood of Dublin.

Kildare—Johnstown Bridge, Nov. 1905 ! P. H. Grierson. Vars. *lutea*, *lilacina*, *olivacea*, etc., Monasterevan, Sept. 1910, A. W. Stelfox and R. A. Phillips.

Wicklow—Greystones, July 1891 ! R. F. Scharff. Enniskerry, Aug. 1904 ! P. H. Grierson.

Wexford—Type and var. *lutea*, roadside hedge between Wexford and Johnstown, Jan. 1911 ! R. A. Phillips.

Carlow—Reported from near Carlow by Mr. R. Welch.

Kilkenny—Type and vars. *lutea* and *arenicola*, Kilkenny, March 1902 ! P. H. Grierson.

Queen's Co.—Type and vars. *albina*, *lutea*, *lilacina*, *olivacea*, *arenicola*, and *fuscolabiata*, Rathdowney, 1908 ! also variable at Portarlinton, Mountmellick, Abbeyleix, Maryborough, Erril, and Durrow, R. A. Phillips. Recorded in 1840 by Mr. W. Thompson from La Bergerie on the authority of the Rev. B. J. Clarke.

King's Co.—Recorded for the county in 1840 by Mr. W. Thompson. Type and vars. *lutea*, *lilacina*, and *olivacea*, plentiful about Birr, 1908 ! R. A. Phillips.

Westmeath—Multyfarnham, 1897, G. P. Farran.

CONNAUGHT.

Mayo W.—Common on sandhills of Bartragh Island, Killala Bay (A. Warren, Zool., 1879, p. 28). Achil Island and Dooniver, Sept. 1888 ! J. G. Milne.

Galway E.—Type and var. *lutea*, hedgerow near Ballinasloe, Feb. 1911 ! R. A. Phillips.

MUNSTER.

Clare—Banks of river Fergus, Ennis, July 1907 ! type shells in graveyard, Drumcliffe, 1910 ; type and var. *lutea* in glen at Lisdoonvarna, R. A. Phillips.

Limerick—Limerick, 1886 ! Dr. W. H. Evans. Type and vars. *lutea* and *arenicola*, common on banks of a small tributary of the river Shannon, Ballinacurra, Aug. 1910 ! H. Fogerty.

Tipperary N.—Roscrea, plentiful, Aug. 1907 ! R. A. Phillips. Recorded from the county by Mr. W. Thompson in 1840.

Tipperary S.—Melview, Clonmel, Sept. 1904 ! Mrs. Malcolmson. Type and vars. *lutea* and *arenicola*, Thurles, R. A. Phillips.

Cork S.—Recorded by Humphreys and Thompson as found rarely about the city of Cork.

Kerry—Dingle, E. Collier.

GERMANY.

Helix hortensis is well distributed over the whole empire, but becomes scarcer in Posen and other eastern districts, where it is replaced by *Helix austriaca*.

It has been actually recorded from Alsace, Bavaria and the Bavarian Palatinate, Baden, Brandenburg, Brunswick, Bremen, Cassell, Darmstadt, Franconia, Holstein, Hanover, Luneburg, Lorraine, Lippe-Detmold, Magdeburg, Merseburg, Mecklenburg, Nassau, Oldenburg, Osnabruck, Pomerania, Posen, Pyrmont, East, West, and Rhenish Prussia, Reuss, Saxony, Schleswig, Silesia, Suabia, Thuringia, Waldeck, Weimar, Westphalia, Wurtemberg, and the Islands of Rugen, Wollin, Heligoland, and Norderney.

FRANCE.

Probably distributed throughout France, becoming scarcer towards the south, but not hitherto reported from many of the central departments. It is less common than *H. nemoralis*, and is probably sometimes confused with the albolabiate variety of that species.

It has been cited from Ain, Aisne, Allier, Alpes Maritimes, Ardennes, Ariège, Aube, Aveyron, Basses Alpes, Basses Pyrénées, Calvados, Cantal, Charente Inférieure, Côtes du Nord, Côte d'Or, Doubs, Drôme, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Haute Marne, Hautes Pyrénées, Haute Savoie, Hérault, Indre-et-Loire, Isère, Jura, Loire Inférieure, Lozère, Maine-et-Loire, Lot-et-Garonne, Manche, Meuse, Morbihan, Moselle, Nièvre, Nord, Oise, Orne, Pas-de-Calais, Puy-de-Dôme, Pyrénées Orientales, Rhône, Saône-et-Loire, Sarthe, Savoy, Seine, Seine Inférieure, Seine-et-Marne, Seine-et-Oise, Somme, Tarn, Vaucluse, Var, Vendée, Vienne, Vosges, and Yonne.

NETHERLANDS.

Belgium—Dispersed throughout the kingdom, and recorded from the provinces of Antwerp, Brabant, West Flanders, Hainault, Liège, Limburg, Namur, and the province and Grand Duchy of Luxemburg.

Holland—Probably occurs throughout the country, but as yet only recorded from Groningen by Prof. von Martens, and from Valkenswaard, North Brabant, by Mr. F. S. Mitchell. It is reported from Gelderland, Limburg, and South Holland by Heer M. M. Schepmann, who also possesses a probably accidentally introduced specimen found at Bosch en Duin, Utrecht.

ITALY.

Though recorded by Porro, Spinelli, and Villa from Lombardy, and by Porro and Jan for Emilia, it is probable that these authors have mistaken the white-lipped form of *H. nemoralis*, so common in Northern Italy, for *H. hortensis*, whose presence there is denied by modern Italian authors. M. A. Locard erroneously quotes it as an inhabitant of Sicily.

SPAIN AND PORTUGAL.

Spain—Prof. Hidalgo reports the species from Aragon at Panticosa, Valle del Cinca, Valle del Essero, Alcala de la Selva ! etc., and from Catalonia at Barcelona, Camprodon, Gerona, Olot, Ribas, Tremp, and other places. It is recorded from Santander, Old Castile, by Mr. E. J. Lowe; and a small form was collected at Valencia in 1885 by Mr. R. D. Darbishire.

Portugal—The records for Cintra, Peña de Orduña and other places given by M. Morelet and others are incorrect, and probably refer to the white-lipped variety of *Helix nemoralis*.

AUSTRO-HUNGARY.

Prevalent in the western and northern parts of the empire, becoming scarcer towards the south and south-east, and totally absent from Transylvania, where it is replaced by *Helix austriaca*.

It has been actually reported from Austria, Bohemia, Croatia, Galicia, Hungary, Moravia, Salzburg, Silesia, Styria, and North Tyrol. It is regarded as a doubtful inhabitant of Carniola and Carinthia, and has been reported by Moellendorff from the Voralpenwäldern in Bosnia.

SWITZERLAND.

Dispersed throughout the whole country north of the Alps; it is on record for the cantons of Aargau, Appenzell, Basle, Berne, Geneva, Glarus, Grisons, Lucerne, Neuchâtel, St. Gall, Schaffhausen, Schwyz, Solothurn, Thurgau, Uri, Unterwalden, Valais, Vaud, Zurich, and according to M. Roffiaen is found at Magadino in Canton Ticino.

SCANDINAVIA.

Norway—Extends to 64° north lat., according to Milachevich. It is reported as widely distributed in Christiania province, but not often numerous, though abounding in the garden and park at Jarlsberg. It is found about Bergen and the Hardanger, Aalesund in Romsdal, and about Trondhjem.

Sweden—It is more generally diffused than *H. nemoralis*, and is found in Skane, Malmöhus, Nerike, Westergötland, and about Stockholm, and extends as far north as Oviken in Jemtland, where it is considered as a relict, its presence being regarded by Herr Hägg as evidence of a warmer climate in early quaternary times.

Denmark—Found throughout Denmark, but is less common than *H. nemoralis*. It is also recorded from the Island of Bornholm.

Iceland—Recorded from Iceland by Dr. O. A. L. Mörch, the specimens, according to Prof. Sandberger, belonging to the var. *ludoviciana*, but no recent records are available, the specimens recorded by Mr. Gratacap as found at Seydisfiord proving to be *Helicigona arbustorum*.

RUSSIA.

Inhabits the Baltic provinces, and has been reported from some of the provinces of South Russia, perhaps confused with the albolabiate form of *H. nemoralis*, which is frequently the most plentiful form at the confines of its range.

It is reported from Poland, Vollynia, Kovno, Courland, Livland, Esthland, Ingemanland, South Finland, and the Aland Isles.

The southern provinces from which it is reported by Kaleniczenko and others are Podolia, Kursk, Kharkov, and Taurida.

NEARCTIC REGION.

DANISH AMERICA.

Greenland—Reported as an inhabitant of Greenland; the record, however, rests upon a single dead shell received from Greenland by Dr. Mörch about 1844, which he himself thought was probably introduced, and upon a manuscript of Dr. Beck, in which he says:—"Wormskiold has told me that he has found on the leaves of the small shrubs of *Salix lanatus*, in the vicinity of the interior of the Gulf of Tgaliko, a small banded snail, not unlike our garden snail."

CANADA.

In Canada this species is at the present time strictly confined to the eastern regions, and has been noted from the provinces of Quebec, Labrador, Nova Scotia, New Brunswick, Newfoundland, and Prince Edward Island.

Quebec—In this province it was first recorded in 1829 by Mrs. Sheppard as common in spring on a bank near the Plains of Abraham, Quebec; Mr. F. R. Latchford notes it from the citadel of that town; and Mr. J. E. de Kay in 1843 recorded that Col. Totten found *H. subglobosa* near the shores of the St. Lawrence, two hundred miles below Quebec.

On the Gaspé Peninsula it is a common shell at many points, the yellow and banded varieties being about equally numerous, Mr. G. H. Clapp reporting the formulæ 12345, 123(45), (123)(45), 1(234)5, (12345), and 00000 as obtained from Gaspé. According to Mr. R. Bell, jun. (Canad. Nat., 1859, p. 215), it was first observed on the mainland on Mount Commis, about nine miles south of St. Luce, and on the coast at Métis, and also further down the river; it was very abundant, and much more numerous than *H. albolabris*, whose place it seemed to occupy. In the Valley of Marcouin *H. hortensis* extends twelve miles inland, attaining an altitude of 1,500 feet, and where the land has been recently cleared and burnt over, their weathered shells may be seen strewn in thousands over the surface of the soil. Dr. J. M. Clarke found it very common on the limestone area at Perce; and Mr. Hanham found that, though generally buried in sand, it was very common on the hillside at Barachois, the unicolorous form being the most plentiful, though the formula (12345) was also met with. According to his information, it extends as far up the River St. Lawrence as the Little Métis River.

On some of the islands in the St. Lawrence it is very plentiful, as on Hare Island and the "Brandy Pots," opposite the Rivière du Loup, where it was found in vast numbers in 1857.

On Anticosti, specimens were collected during the "Arethusa" Expedition in 1880 at Wreck Harbour, East Cape, and are now in the collection of the Boston Society of Natural History.

At Grand Entry, Magdalen Islands, a number of specimens, all with yellow ground colour, were collected in 1901 by a member of the Carnegie Museum Expedition to Labrador, the prevalent variety being 12345 with (12)345 of much less frequent occurrence, although a noticeable tendency of the bulk of the specimens towards the coalition of the two upper bands was perceptible; while the formulae 12045 and 00000 were quite rare. The formula 00300 was not rare, but were all referable to the var. *arenicola*.

Nova Scotia—Recorded from Halifax and Cape Breton Island by Dr. W. H. Dall.

New Brunswick—Reported by Prof. E. S. Morse and others from the Island of Grand Manan.

Prince Edward Island—Var. *lutea* found by Mr. Ives on Curtain Isle, Richmond Bay (Nautilus, Dec. 1906, p. 95).

Newfoundland—*Helix hortensis* ranges along the greater part of the west coast, but has not yet been met with on the eastern seaboard. It occurs in considerable numbers in the damp wooded valleys of the Great and Little Codroy Rivers, but chiefly in the latter, the shells collected in the Little Codroy valley by Mr. Gratacap being thin, with dull reddish-brown bands and yellow ground colour, comprising the var. *subglobosa* Binney, with var. *lutea* 00000, 12345, (12345), and (123)45.

Mr. G. H. Clapp records it as found near the head waters of Robinson's River, with the formulae (12345), 1(234)5, and 00000. In 1905 it was discovered by Mr. J. Bryant, jr., at the Serpentine River, and at the mouth of the East River in Hawkes Bay by Dr. John Bryant; at the latter place a good series were obtained in 1906 by Drs. C. W. Townsend and G. M. Allen of var. *lutea* 00000 and (12345), and all were feeding upon the cow parsnip.

Baron Férussac recorded it as living on the Islands of St. Pierre and Miquelon as early as 1822, which probably constitutes the earliest record of this species for the Nearctic region.

Labrador—A specimen in the British Museum, labelled "*H. hortensis*, Labrador, Lady Douglas." It is an example of var. *lutea*, with somewhat transparent bands, showing the formula 10345, a form distinguished by Moquin-Tandon as var. *vallovia*.

UNITED STATES.

Maine—Dr. Gould in 1841 cited the "region of Portland" as one of its stations; and Dr. Mighels in 1843 reported the var. *lutea*, 00000, 12345, etc., the var. *rufizonata*, the var. *arenicola*, and a sinistral specimen as found by Capt. Walden on one of the little islands in Casco Bay; Mr. C. W. Johnson gives Spruce Head; Mr. Schick collected it at Bar Harbour; and Mr. G. H. Clapp the banded variety (12345) at Cape Porpoise near Kennebunkport.

Prof. Morse in 1864 recorded it as abundant on several islands from Casco Bay to Grand Manan. On Eagle Island, one of the extreme outer islands of Casco Bay, it occurs in great profusion, clinging to the dwarf wild pear.

On Brown Cow Island, Dr. A. S. Packard found the "olive-green" variety to be the predominant form, but blending into the var. *lutea*, the var. *arenicola* and banded forms each constituting about ten per cent. of the total shells found.

Rev. H. W. Winkley has found the species on Inner Green Island; Mr. W. H. Weeks, junr., on Cliff or Crotch Island; Mr. H. K. Morrell reports it as living on Pumpkin Knob on the east side of Sheepscot Bay, and as abundant on Matinicus.

Mr. H. S. Colton and Mr. Blaney record it as common on Little Duck Island, near Frenchman's Bay; Mr. Owen Bryant found the five-banded form on Seal Rock, an islet of the Matinicus group; Mr. A. H. Norton on Mosquito or Little Egg Rock, Muscongus Bay; and Mr. G. W. Clapp has found it on Bar Island, and at Bar Harbour on the mainland, all the specimens being characterized by the total absence of bands, or their reduction to a very faint and transparent condition, with the formulae 12300, 00300, and 003x40.

New Hampshire—Specimens in the Whittemore Collection, found by Capt. Sloane, on Wood Island, Portsmouth.

Vermont—Amos Binney in 1851 recorded that this species was said to occur in the northern part of Vermont.

Connecticut—The Connecticut record is based entirely upon its inclusion in Linsley's Catalogue of the Shells of Connecticut, published in 1845, in which the species is reported as '*Helix subglobosa* (?) Binney, Weston, Gould, 172,'; according to Mr. C. W. Johnson this record must be regarded as very doubtful.

Massachusetts—In 1837 Mr. Amos Binney recorded the "olivaceous yellow" bandless variety, *Helix subglobosa*, as common on the lower parts of Cape Cod and Cape Ann, also as abundant and the sole variety living on Salt Island, a rocky uninhabited islet near Gloucester, but in 1851 he reported that banded varieties had appeared and were not uncommon there.

Binney and Bland described it as existing in countless numbers on the soil and shrubs of some of the islands in the vicinity of Cape Ann.

Mr. J. H. Thomson in 1885 records finding the var. *lutea* in large numbers near Gay Head on the Island of Martha's Vineyard, but never on the mainland, although he unsuccessfully tried to establish the species in his garden at New Bedford. Mr. C. W. Johnson, however, states that it is found on the mainland at Manchester, Magnolia, Gloucester, Rockport, and abundantly on the steep bluffs by the lighthouse at Chatham, in which locality all the specimens belonged to the sub-var. *subalbida*.

Mr. J. Ritchie cites Cambridge as a locality on the authority of specimens in the Whittemore Collection; and Mr. F. N. Balch has found it near Orleans.

The var. *lutea* has been found by Mr. Thaxter at Provincetown, and the light yellow sub-variety (probably the var. *lutescens* Schmidt) among cedars near "Old Harbour," Cohasset, by Mr. A. P. Morse.

It was also enumerated in 1853 by Mr. S. Tufts, jun., in his "List of Shells collected at Swampscot, Lynn, and Vicinity."

On the islands off the coast, Dr. Gould in 1851 recorded it as found abundantly by Dr. Cabot on House Island near Manchester, and Outer Gooseberry Island, each island possessing its own distinctively fasciate variety. In 1870 Dr. Pilsbry reported the species from New Bedford and Marblehead; the var. *lutea* and its four and five-banded sub-varieties with the var. *arenicola* 12345, from the Island of Nantucket, at Sciasconset, on the authority of Dr. Allen; and the var. *lutea* from the town of Nantucket, and the adjacent Island of Tuckernuck, on that of Dr. Benjamin Sharp. Mr. C. W. Johnson recorded it as found on Morris Island, a wooded island south of Chatham by Mr. L. R. Reynolds; while Dr. W. G. Binney in 1885 cited it from Kettle Island, near Cape Ann, from Eagle Island, near Marblehead, etc.

Prof. Cockerell records from Magnolia the typical form, the vars. *lutea* and *rufizonata*, and the sub-vars. *pallida*, *subalbida*, and *subglobosa*, and from Rockport the vars. *lutea* with fifteen different band arrangements, including 00000, 12345, 123(45), (123)(45), 10345, and 12045; the var. *arenicola*, 12345, and the sub-vars. *subglobosa* and *subalbida*, all collected by Mr. G. H. Clapp, who remarks that the bandless and faintly-banded shells were by far the most common.

New York—Monroe county, but said to have been introduced (J. Walton, Nautilus, 1898, p. 133). Flushing, Long Island, 1885, W. M. Beauchamp. Binney and Bland cite a specimen in the Collection of the Smithsonian Institution received from Mrs. H. W. Parker, and collected at Ludlowville, Cayuga Lake.

Nebraska—Dead shells found in Richardson county, but they may have been brought there by Indians (Aughey, Bull. Surv. Terr., 1877, p. 698).

AUSTRALASIAN REGION.

New Zealand—Recorded by M. H. Crosse on the authority of Mr. H. Suter.

Otto Friedrich Müller

FIG. 405.—Facsimile of the Autograph of O. F. Müller, appended to his introductory letter to Linné, dated from Copenhagen, March 30th, 1762.

(Reproduced by kind permission of the Linnean Society of London).

SUB-GENUS *Euparypha* Hartmann.*Helix pisana* Müller.

1711 *Cochlea pisana minor umbilicata* Petiver, *Gazophylacium Naturæ*, Decas Sexta, tab. lii., f. 12; *Catal.*, p. 2, no. 145.

- 1774 *Helix pisana* Müller, *Verm. Hist.*, pt. ii., p. 60.
 1777 — *zonaria* Pennant, *Brit. Zool.*, p. 137, pl. 85, f. 133.
 1792 — *petholata* Olivi, *Zool. Adriat.*, p. 178.
 1801 — *rhodostoma* Draparnaud, *Tabl. Moll.*, p. 74.
 1803 — *eingenda* Montagn, *Test. Brit.*, vol. ii., p. 418, pl. 24, f. 14.
 1817 — *strigata* Dillwyn, *Recent Shells*, vol. ii., p. 911.
 1840 — (*Helicomanes*) *pisana* Gray, *Turton's Manual*, p. 158, pl. iv., f. 30.
 1860 — *catocyphia* Bourg., *Mal. Chateau d'If*, p. 13, pl. 1, ff. 1-3.
 1880 — *pisanopsis* and *hyperplatæ* Etude *Moll. Espagne*, etc., pp. 112, 114.
 1887 — *agarvi*, *carpiensis*, *djerbanica*, *gergisensis*, *hamadanica*, *saïemensis*, *monroi* and *zitanensis* Letourneux & Bourguignat, *Prodr. Mal. Tunis.*, pp. 78, 80.
 — *chambardi* Letourneux, *Prodr. Mal. Tunis.*, pp. 79, 82.
 — *couturieri*, *cuttati*, *lenoleuca*, *subpisana* and *thinophila* Bourg., *Prodr. Mal. Tunis.*, pp. 79, 80.
 — *donatii* and *levesquei* Berthier, *Prodr. Mal. Tunis.*, pp. 80, 83.
 — *byrsæ* and *radesiana* Marès, *Prodr. Mal. Tunis.*, pp. 80, 83.
 — *dermoi*, *pisanelle* and *olivaresi* Servain, *Prodr. Mal. Tunis.*, pp. 80, 83.
 1899 — *burbozana*, *bocagei* and *machadoi* Locard, *Conch. Portug.*, pp. 50, 52.
 1826 *Theba pisana* Risso, *Moll. Alp. Marit.*, p. 73.
 1828 *Caracolla maculata* Menke, *Syn. Meth. Moll.*, p. 25.
 1837 *Xerophila pisana* Held, *Isis*, p. 913.
 1840 *Euparypha rhodostoma* Hartmann, *Erd. Sussw. Gast.*, i., p. 204, pls. 79, 80.



H

HISTORY.—*Helix pisana* though recorded by Petiver, in 1711, from specimens collected near Pisa in Italy, was first binomially distinguished by O. F. Müller, although Mr. Hanley found immature shells of this species in the Linnean collection, which he judged may have been intended to represent *H. leucas*, as there were no other shells in the cabinet that corresponded with the Linnean diagnosis, yet this evidence of identity is not sufficient to permit us to supersede the universally adopted Müllerian name.

This species is the type of the group *Euparypha*, and is characterized by a narrowly perforate, subdepressed, calcareous shell, and the splitting-up of its spiral bands, while the aperture is internally thickened but not expanded, and although a Pentatæniate species, has the banding so greatly disintegrated that it is difficult to recognize the quinquefasciation.

Helix pisana was added to the British fauna by Pennant, who described the shell as a native species in his *British Zoology*, published in 1777.

With this species it is a pleasure to associate the Marquis Monterosato, a life-long and distinguished student of the mollusca, and the author of many invaluable authoritative works, who has especially studied the present species and differentiated some of its more interesting variations.

Monterosato

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Published February 16, 1912.

Rec'd Mar. 9/12

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—SAMUEL WOOD GEISER,
University, Fayette, Iowa.

Diagnosis.—*Helix pisana* differs essentially from *Helicella virgata*, the species with which it is most liable to be confounded, by its larger size, more depressed shape, almost closed umbilicus, and the generally numerous slender spiral bandlets on the upper surface, while *H. virgata* has usually only one broad band in that position, and the umbilicus is always quite open and distinct. The presence of a close series of well defined incised spiral lines presents a striking character, as these are not possessed by *H. virgata*.

It is, however, more closely allied to *H. hortensis*, but differs in wanting the beautifully reflected outer lip of that species, and in possessing numerous distinctly incised lines encircling the whorls, which in *H. hortensis* are only occasionally and feebly perceptible, while in *H. pisana* the umbilicus is invariably partially open, but always entirely closed in adults of *H. hortensis*; there is, also, a peculiar squareness or shouldering of the whorls in *pisana*, which with its more depressed spire impart a characteristic aspect to the shell.

INTERNALLY, it differs from *H. virgata* in many important points: the right tentacular retractor in *H. pisana* passes between the branches of the genitalia, while in *H. virgata* it is quite free; the vaginal mucus glands are simple in the present species and multifid in *H. virgata*, which has also a short flagellum, an organ quite absent in *H. pisana*.

Though closely linked with *H. hortensis* by the complex structure of the gypsobelum or love-dart, it differs in being totally destitute of a flagellum to the penis sheath, the great development of which organ is so striking a feature in that species. It also possesses a long and stout diverticulum to the spermatheca-duct which is closely bound to the oviduct by a richly vascular membrane, as in the *Helicigona*, with which group the vaginal glands are also in accord.

Description.—The ANIMAL has an elongate and more or less transparent BODY, the viscera being perceptible through the skin; it is obtuse and thick in front, tapering to a flat and pointed yellowish TAIL; the DORSUM usually appears of a pale translucent grey by direct light, but occasionally is of a darker grey, or even a delicate fawn; the SOLE is yellowish, gradually passing into the grey or other tint of the dorsal surface; the rugosities are well marked, but not protuberant; the paired DORSAL GROOVES enclose a row of indistinctly separated and flattened tubercles; the GENITAL FURROW is not well defined, but is present on both sides of the body, and does not constitute a dividing line separating different characters of granulation as in certain other species; the tubercles on the muzzle beneath the upper and lower pair of tentacles have their summits thickly sprinkled with minute dark or black specks, especially at the bases of the upper pair, where they present the appearance of a triangular black spot; the OMMATOPHORES are long, slender, and sensibly tapering, finely but distinctly granular, and abruptly swollen at the apex, of a pale translucent grey, through which the dark RETRACTORS are distinctly visible, and also for a distance on the dorsum; LOWER TENTACLES about two mill. long, slightly swollen and translucent at the apex, each showing the dark retractor, which appears to join that of the larger tentacles six or seven mill. from their base; the MANTLE is dark blackish grey, indistinctly speckled with pale grey, contrasting with the pale translucent body when the animal is within the shell, the part against the penultimate whorl appearing quite black; the RESPIRATORY ORIFICE is irregularly surrounded with dull white; the SLIME is thin and colourless, but not viscid, and becomes iridescent when dry.

The PEDAL GLAND, according to M. André, is much reduced in development, and in some parts formed by the excretory canal only; the roof has, however, the characteristic longitudinal folds, and the pedal artery is united to the gland, but it is curious to be so feebly developed in a species which lives so largely on thistles, *Eryngium*, and other rough plants, though, on the other hand, it is an animal of very sedentary habits, and frequently rests a long time in the same place.

The EPIPHRAGM is thin, transparent, and vitreous, bestrewn more or less freely with minute, opaque-whitish calcareous particles; opposite the respiratory orifice there is often a dull white area, joined up to the outer lip, and irregularly outlined;

the CICATRIX or place where the mantle was last in contact with the completed epiphragm is sometimes very distinct. It is usually affixed to the apertural rib, and though it may be sunk much deeper at the upper part, is always practically level with the aperture at the columella.

SHELL subglobose, somewhat depressed above and convex beneath, somewhat solid, but inclined to be translucent, of a dull whitish colour, encircled by numerous dark spiral bands of variable width and intensity, and frequently interrupted or broken; WHORLS $5\frac{1}{2}$ or 6, rapidly increasing in size, irregularly striate in the line of growth, and with numerous and in certain parts closely-set incised lines encircling the whorls, and with the lines of growth frequently presenting a decussate or reticulate appearance; SUTURE shallow; NUCLEUS smooth and usually of a dull purplish-brown hue, but frequently colourless and translucent; APERTURE rather oblique and rounded, usually whitish, of a delicate buff or pink internally, with a slight submarginal RIB of a whitish, yellowish, or rosy tint; outer margin sharp but thickened, somewhat abruptly inflected above and distinctly reflected below, and partially covering the UMBILICUS, which is oblique and narrow. Diam. 18 mill.; alt. 14 mill.

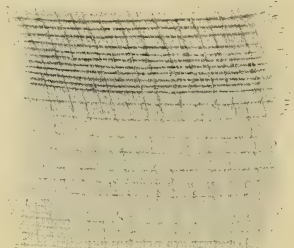


FIG. 407.—Magnified sculpture of the body-whorl in *Helix pisana* Müll. (From photo. by Mr. W. Bagshaw).

INTERNALLY, the RETRACTOR of the RIGHT OMMATOPHORE, as in the true *Helices*, passes between the male and female organs of the reproductive system.

The KIDNEY or precordial gland is light buff in colour, irregularly covered with darker spots, which are sometimes disposed in two series or rows; the lenticular PERICARDIUM being closely apposed to its concave side; the HEART shows a dull white VENTRICLE, which is somewhat larger than the transparent, colourless, and more delicate AURICLE.

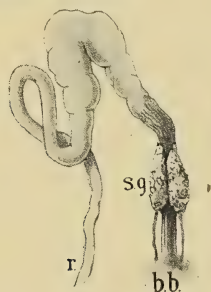


FIG. 408.



FIG. 409.



FIG. 410.

The Alimentary and other organs of *Helix pisana* Müller.

FIG. 408.—Alimentary organs, $\times 3$. bb. buccal bulb; s.g. salivary glands; r. rectum.

FIG. 409.—Pericardium and heart with the precordial gland or kidney, $\times 3$.

FIG. 410.—Albumen gland and hermaphrodite duct, with the vesicula seminalis, $\times 3$.

The ALIMENTARY SYSTEM shows the usual triodromous intestinal coiling; the OESOPHAGUS is stout and towards the crop is longitudinally striped, and its median portion enveloped by the well-developed, whitish, SALIVARY GLANDS; the CROP and the STOMACH at the termination of the INGESTIVE TRACT blend together, and the stomachal expansion is continued beyond the terminal fold. The LIVER or digestive gland is of a light brown colour in the upper lobes, but darker in the more basal lobules; the HEPATIC ARTERY is of a transparent dull greenish tint, but somewhat indistinct.

The REPRODUCTIVE ORGANS show a well developed but loosely aggregated OVOTESTIS, more or less imbedded in the liver; the HERMAPHRODITE DUCT is simple and direct distally, becoming closely tortuous as it approaches the ALBUMEN GLAND, which is of the usual linguiform shape; the VESICULA SEMINALIS or claw is somewhat large, glandular in structure, and is formed of strongly wrinkled grey and black transverse segments; OVIDUCT distinctly sacculate and whitish in colour with the SPERM DUCT closely apposed; the SPERMATHECA is small and globosely

oval, borne upon a long and slender duct, from which arises a stout and well developed DIVERTICULUM, the whole being closely attached to the OVISPERMATODUCT by a richly vascular membrane, as in the *Helicigona*; the FREE OVIDUCT is well developed and bears a pair of long, slightly sacculate and tubular yellowish or brownish MUCUS GLANDS, which are most capacious at the ends, and partially

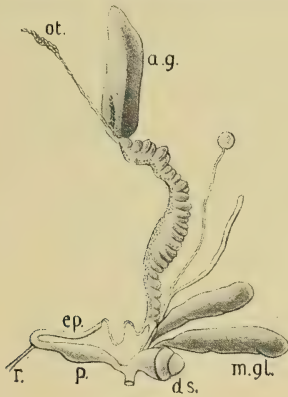


FIG. 411.

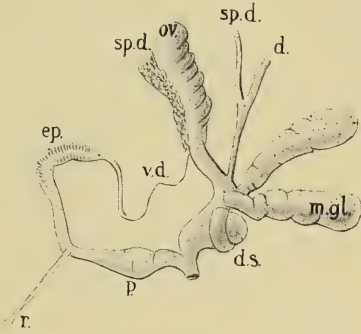


FIG. 412.

FIG. 411.—Reproductive organs of *Helix pisana* Müller, from Jersey, $\times 2$.

FIG. 412.—Proximal portion of the Reproductive organs of *Helix pisana* Müller, $\times 4$, showing the character of the epiphallus.

a.g. albumen gland; d. diverticulum; d.s. dart sac; ep. epiphallus; m.gl. vaginal mucus glands; ot. ovotestis; p. penis sheath; r. penial retractor; sp. stem of spermatheca; sp.d. sperm duct; ov. oviduct; v.d. vas deferens.

embrace the dart sac, in which feature, as well as in their simplicity, they conform to the arrangements in *Helicigona arbustorum* and *H. lapicida*; the PENIS SHEATH is somewhat long, with a median thickening, which is of an opaque yellowish-white, the ends being of a transparent azure-white; the RETRACTOR MUSCLE is of a transparent light azure, and is fixed at its distal end, which is continued to form a long and stout EPIPHALLUS, which is abruptly bent, and lies parallel to the penis sheath, to which it is fixed by muscular tissue; it is proximally of a light azure, but becomes bulkier and of an opaque milk-white in the distal half, and shows by transmitted light several series of closely arranged transverse markings, arranged longitudinally, and probably indicative of an internal structure which will impart a specific facies to the spermatophore formed therein; there is no flagellum, which has probably become atrophied and lost, and the vas deferens enters the epiphallus terminally.

The DART SAC or stylophore is small and obovate, of a pearly-white aspect, and is encircled externally by a prominent median external ring or girdle, suggesting the form of an acorn. The immature dart-sac before the secretion of the dart takes place, shows in longitudinal section a tripartite lumen or cavity of which the basal limbs surround the tubercle which supports the dart on the fundus of the sac and secretes the annulus, the remaining limb of the cavity extending in the direction of the future aperture from which the dart will be protruded.



FIG. 413.

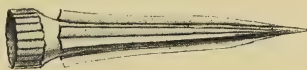


FIG. 414.

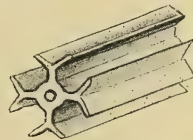


FIG. 415.

FIG. 413.—Section through the immature dart sac of *Helix pisana*, before the formation of dart, $\times 6$.

FIG. 414.—The fully mature Gypsobelum or love dart of *Helix pisana*, $\times 15$.

FIG. 415.—Section through the median portion of the Gypsobelum or love dart, showing the structure and arrangement of the blades, $\times 30$.

The DART or gypsobelum is very small (scarcely $2\frac{3}{4}$ mill. in length) for the size of the animal, and scarcely larger than that of *Helicella asperata*, but in structure it entirely conforms to those of the Pentatæniate group. It has a short straight shaft, expanding rather abruptly at the base, and provided with four symmet-

rically disposed longitudinal blades, which are thin and translucent, and set at right angles to each other, their edges being split along their entire length and diverging to form distinct flanges, which are inclined to each other at an angle of about 150 or 160 degrees, forming a longitudinally channelled termination to the edge of each blade, and disappearing somewhat gradually before reaching the apex of the dart, but ending quite abruptly and squarely about the middle of the basal expansion, which is terminated by a distinct annulus, composed of from twelve to sixteen longitudinal rodlets, which are only formed on completion of the dart.

The JAW is a well-arched structure, quite convex from front to back, and nearly two millimetres broad from side to side, with bluntly rounded ends; of a somewhat deep fawn colour, becoming brown in the thicker parts, and bearing two stout transverse and usually divergent ribs which strongly denticulate both the upper and lower margins, and are always near the centre of the mandible where a third rib is frequently developed between the usual pair.

The strength of the jaw and its degree of denticulation is, however, largely a matter of environment, and varies within certain limits in different districts.¹

The bicostulate mandible is the most common form in this country, although specimens with three ribs are frequent and occasionally met with even in quite immature shells, the ribs at this stage usually, however, only indent the lower or cutting margin. In France, Moquin-Tandon describes the divergently bicostate jaw as a characteristic of the species, but M. Girard states that in Portugal the bicostate mandible is restricted to immature individuals, and that all fully adult shells possess a tricostulate jaw.

The RADULA is of the usual oblong shape, and about 5 mill. in length and 1½ mill. in width, composed of 140 or more gently curving transverse rows of teeth, which diminish gradually in size towards the margins, where the rows exhibit a tendency to furcate, or short additional rows may be interposed at intervals; each row is constituted by about 87 teeth, consisting of a tricuspid MEDIAN tooth with a strong mesocone and a small but distinct ectocone on each side; the LATERALS are usually about sixteen in number and bicuspid, the endocone being lost and the ectocone

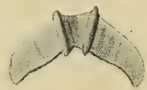


FIG. 416.—Jaw of an adult *Helix pisana* Müller, × 10, from Jersey.

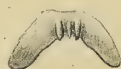


FIG. 417.—Jaw of a young *Helix pisana* Müller, × 10, from Jersey.

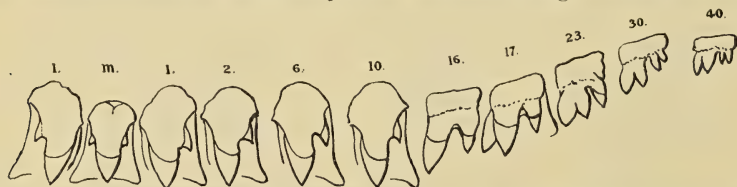


FIG. 418.—Representative denticles from the radula of *Helix pisana*, Tenby, highly magnified (based on a photograph by Mr. W. Bagshaw of a preparation by Rev. Prof. H. M. Gwatkin).

becoming gradually stronger and more prominent as the teeth recede from the median line; the MARGINALS are about twenty-seven in number, and show a distinct bifurcation of the mesocone, the ectocone being quite separate and distinct, and about the thirtieth row also tending to become bifid, many of the teeth near the outer fringe being distinctly quadrid.

The formula of a Tenby specimen prepared by Rev. Prof. H. M. Gwatkin is

$$\frac{27}{3 \cdot 4} + \frac{16}{2} + \frac{1}{3} + \frac{16}{2} + \frac{27}{3 \cdot 4} \times 140 = 12,180 \text{ teeth.}$$

Reproduction and Development.—Little is known of the amours or life history of this species, but, according to Dr. Gassies, congress takes place during June and July, and although Moquin-Tandon denies that a spermatophore is secreted by this species, the well-developed and glandular epiphallus would seem to emphatically controvert that statement, and render it almost certain that the fertilizing element is transferred during pairing by means of a perfectly characteristic spermatophore.

The eggs are described as about one-and-a-half millimetres in diameter, oval in shape, and greenish or pearly-white in colour, with a slight invest-

ment of an iridescent mucus, which imparts to them a somewhat glossy appearance; they are laid about a week after pairing, the period of oviposition, according to Dupuy, extending from the end of summer to as late as Nov. 25th; the eggs are usually about sixty in number, but said to be deposited at three different times, just beneath the surface of the ground, probably beneath stones and at the roots of shrubs or plants; they hatch in about twenty days, and emerge from the ground bearing a shell nearly two mill. in diameter.

In the course of its growth the young shell displays some very striking modifications in its aspect, and Dr. Germain in the south of France and M. Girard in Portugal have studied the various phases of development they undergo, recording that the young are hatched towards the end of autumn, slowly increasing in size throughout the winter and following spring until the time of æstivation causes a cessation of growth; at this period the shell, which is usually whitish and relatively thick, has attained three to four whorls, and shows affinity in form with immature *H. lupicida* and with the adults of *Helix explanata*, in having a subtetragonal mouth, a very flat spire and an exceedingly deep and convex base, separated by a very acute and distinct keel. Before its summer siesta, the animal strengthens the aperture of its shell and secretes a strong and calciferous epiphragm, by which it affixes its shell securely to fully exposed stone walls or stems of plants and trees, particularly favouring those of the Broom (*Sarothamnus scoparius* L.), but many die during this period, which seems a very critical one in its life's history.

The young shell in this condition is found throughout the range of the species, and was long ago named *Carocolla cinea* by Klett; it is also probably the *Helix æstivalis* of Bourguignat, and more recently has been distinguished as *Helix catocyphia inermis* by Girard.



FIG. 419.—*Carocolla cinea*
Klett, Tabarka, Tunis
(after Dr. Germain).
(Mus. Hist. Nat. Paris).

The *Helix hyperplatea* of Servain, which was founded on specimens discovered in the Iberian peninsula, and has also been found plentifully on the dunes of Tabarka and in the region of Ain-Draham, Tunis, by M. de Kerville, was also evidently established on immature shells whose growth has been arrested at a somewhat later stage of life than that of the *Catocyphia inermis*, as the body whorl is described as only keeled at its origin, the periphery rounded towards the aperture, the spire more convex, and the peristome thicker; while the *Theba leucostoma* Risso is also said to be an immature stage of the species.

At this stage of its development, but only in hot and arid littoral situations on calcareous, basaltic, or sandy and possibly alkaline soils, a cretaceous tubercle may be occasionally developed which is usually placed on the middle of the parietal wall, but occasionally at the base of the columella or even upon the outer lip.

This peculiar juvenile and probably atavistic form, which differs so strikingly from the adult, was regarded as a distinct species, and named *Helix catocyphia* by Bourguignat, and placed by Locard in the genus *Tropidocochlis* with *Helix explanata*, while M. Charreyre actually regarded it as a variety of that species; M. Girard has, however, demonstrated that it is merely a juvenile and undeveloped form of *Helix pisana* with scarcely a perceptible trace of the reproductive organs, which occupy so large a part of the body cavity of adults.



FIG. 420.—
Helix catocyphia Bourg.,
Arzen, Algeria,
Mr. G. K. Gude.
(slightly enlarged).

This local and possibly atavistic form is more common in Portugal than in France, where it is known to occur at Palavas, Hérault; Port Vendres, Pyrénées Orientales; and also at Catalans, and Chateau d'If near Marseilles. In Portugal, it is found at Lisbon, Monsante, Alcolena, Evora, and Leça. In Morocco, at Mogador, Tetuan, and plentifully at Melilla and Tangiers; and in Algeria, exists about the vicinity of La Macta and Arzen, and is common in many places on the coast.

On awakening from its summer siesta, after the first rains, at the end of autumn, the growth is renewed and takes place more rapidly, the new growth differing remarkably by its pigmentation and delicacy from the earlier portion, but the shell is gradually thickened before maturity, which is attained in the following spring, about eighteen months after birth, but extending over portions of three years.

In England, the shells become full grown about July, but our summers are seldom sufficiently prolonged to allow of the lip being perfectly developed, and few mature individuals would appear to survive their first hybernation, as only a very limited number of living adults can be found in spring, though hundreds of dead ones strew the ground, and the young are active and abundant.

Habits and Habitats.—*H. pisana* is most plentiful in dry and arid regions, especially within the influence of the sea; it lives and prospers under a variety of conditions, on dry sandy plains, in gardens and fields, by roadsides, in hedges and on hill slopes, usually adhering in great profusion to thistles and other plants, the trunks and stems of trees and bushes, and on walls, usually in places fully exposed to the sun, the animal having a wonderful capacity for enduring solar heat.

Though in hot weather they do not seek the shade, generally living during the day attached to the vegetation or other support by a strong epiphragm, yet they occasionally during long continued drought, as observed at St. Ives, Cornwall, bury themselves some inches deep in the sand at the roots of *Carex arenaria* or other plants, but the young are stated to invariably select and remain fixed in positions fully exposed to the sun.

At Tenby, even in winter, according to the observations of Mr. Stubbs, the adults when hibernating do not seek shelter from the cold by burrowing or by hiding in suitable crevices, but still continue to cling to the dead stems of the herbaceous plants upon which they feed in summer, and are mostly destroyed by the trying conditions to which they are exposed.



FIG. 421.—*Helix pisana* congregated on its food plant at Tenby (from photograph by Mr. C. H. Moore).

Mr. Stubbs also remarks that at Tenby it associates freely with *H. virgata*, but is apparently a successful competitor of *H. itala* and *H. acuta*, these mollusks being always absent from the area occupied by the present species.

Food.—*H. pisana*, though showing various local preferences, would seem to be quite omnivorous, as where they are found they often exist in such multitudes, that after rain especially, they swarm over everything, and much latitude in choice of food seems quite impossible.

In Jersey, the Wild Radish (*Raphanus raphanistrum* L.) and the Wall-flower (*Cheiranthus cheiri* L.) would appear to be the favourite plants, although the Thistles are frequently quite covered with them.

In Guernsey, the Thistle (*Carduus pycnocephalus* L.) would appear to be the favourite plant at Vale Castle, as the Wild Radish close by is quite neglected; while at Vazon Bay, Mr. G. S. Tye found the shells clustering upon the Wild Cabbage (*Brassica oleracea* L.), and nestling at the roots of Sea Pink (*Armeria maritima* Willd.); while at the head of Bordeaux Harbour it lives on the Thistles and Wild Fennel (*Feniculum vulgare* Gaertner).

At Tenby, they usually frequent Alexanders (*Smyrniium olusatrum* L.), Valerian (*Valeriana officinalis* L.), and Wild Sage (*Teucrium scorodonia* L.), but on the burrows they swarm upon the Sea Holly (*Eryngium maritimum* L.) and Ragwort (*Senecio jacobaea* L.).

In France, M. Millet reports them feeding on *Eryngium maritimum* in the department of the Loire Inférieure, and Dr. Gassies on Sainfoin (*Onobrychis sativa* Lam.) at Agen.

In Calabria, according to the Marchioness Paulucci, they feed upon the Euphorbia and the Indian Fig (*Opuntia* sp.).

In the Canary Islands, Captain Farrer found them mostly upon the Aloe (*Agave americana* L.) and Prickly Pear (*Opuntia dillenii* Haw.); while the var. *graseti*, which lives on the mountain slopes, feeds exclusively upon the *Euphorbia balsamifera*.

In Egypt, it lives upon *Peganum harmala* L., a strongly scented shrub, whose seeds were formerly used in the dyeing industry; and in Algeria and elsewhere has been observed on the Oleander.

The Rev. A. H. Cooke records their carnivorous propensities, as they destroyed and devoured some *H. itala* during a brief confinement together in the same box; and Mr. R. A. Phillips has recently had a similar experience, some specimens confined for three days in the collecting-box, killed and ate several specimens of *H. virgata* which were imprisoned with them; while Mr. C. Ashford accuses the species of cannibalism, as he found that several specimens, enclosed in the same box for transit through the post, had killed and partially devoured one of their companions during the journey.

Uses.—At Trapani, Sicily, and probably at other places, this animal is used, according to Mr. L. E. Adams, as bait for the smaller sea-fish. The shell is broken and the animal removed and put bodily upon the hook.

In France, Italy, and Algeria it is regularly brought to market, and is used as food by the people, although, according to Lallemant, it has a sour after-taste.

At Marseilles market it is sold at the rate of three francs per fifty kilogrammes (nearly 112 lbs.).

Enemies.—Few precise observations are available on this subject, although their destruction by birds is frequently alluded to; Messrs. Baring and Grant have, however, recorded the finding of seven shells of this species in the crop of a Kestrel shot on the Salvages, and M. Raeymaekers in Belgium found recognisable fragments of shell in the crop of a Wild Duck.

Geological Distribution.—PLEISTOCENE.—Although *Helix pisana* has not as yet been found in any Pleistocene deposits in this country, it has been recorded from the limestone beds on the sea-coast at Fouka near Koléah in Algeria by M. Bourguignat.

HOLOCENE.—In the Channel Isles, it has been recently discovered by Mr. J. Sinel “in yellow clay or loess” beneath undisturbed soil, and undoubted Neolithic relics, at a depth of from five to seven feet below the present land surface, on Green Island, an islet in St. Clement’s Bay, Jersey.

In France, it is recorded as rare by Abbé Dupuy from the rocks of Cardés à Lectoure, Gers, but some of the shells show more affinity with *H. variabilis*.

From Sicily, the Marquis Monterosato reports the finding of the var. *thalassophila* in the beds on Monte Pellegrino near Palermo.

In the Balearic Isles, the Rev. R. Ashington Bullen records the finding of specimens to a depth of eight feet in a hill-wash of holocene age at Porto Pi, near Palma, in the Island of Majorca.

In Madeira, Baron de Paiva indicated it as rare in the fossiliferous strata of Caniçal, but the Rev. Dr. Boog Watson, who visited the locality, found living specimens abundant there, and observed that dead and bleached shells may be picked up, filled with the calcareous sand of the fossiliferous bed, and having all the appearance of being truly fossil, but he never found any truly fossil specimens there.

In the Canary Islands, Mr. J. Cosmo Melvill has holocene specimens of var. *grasseti* collected by Mr. T. V. Wollaston on the Island of Fuerteventura.

Variation.—*Helix pisana* is a species which has been happily described as diffusely polymorphic, its variations being so numerous that it has been split up or dismembered to form quite a number of varieties and so-called species, and received a multitude of names, the precise significance of many of them being now, however, almost unascertainable.

Rossmässler, who has studied the banding of this species, remarks that the five normal bands of the Pentatænia are rarely all present and perfectly developed on the same specimens, but are always broken up or split into still more delicate bandlets. The first and second bands, so seldom seen in the *H. virgata* group, are, however, usually both present, but often represented by fleckings, and more rarely in the form of two to four thread-like bandlets. The third band is placed well above the periphery, and in normal specimens does not reach the suture on the penultimate whorl. The remaining bandlets belong to the fourth and fifth bands; the fourth band is usually broken up into five or six interrupted bandlets. The fifth band, though occasionally split into two delicate bandlets, is commonly undivided, but much broken up and fringed, and seldom sharply defined.

MM. Bourguignat, Servain, Letourneux, and others of the “Nouvelle Ecole” have given the species almost a generic significance by describing numbers of its modifications as of specific value, but none of the forms so

honoured were based upon structural differences of the animal inhabitant, and the bulk not even figured by their authors, though verbosely described, but in such general terms that little aid to identification is afforded, and judging from an examination of a series of authentic types in the collection of the Muséum d'Histoire Naturelle of Paris, these so-called species are allowed so great a range of variation and are so hopelessly intermingled that little systematic value can be attached to them.

Dr. Germain describes and figures a specimen which may be known as var. *biangulata*, collected by M. de Kerville from the dunes of Tabarka, Tunis, which shows a basal angulation in addition to the more usual supra-peripheral one.

As in other fasciate species, the pigment secreting cells may occasionally atrophy at the termination of a growth period, before the maturity of the shell takes place, the growth afterwards made being wholly or partially deficient of the banding present on the earlier whorls, or on the contrary, the secretory power may be latent or undeveloped in the young shell, and gradually or more rarely suddenly develop at the commencement of a growth period and continue in full vigour until maturity has been attained.

The delicacy of the linear banding is also an indication that owing to its exposed habits of life the banding is breaking-up and disappearing, for in less open and more shaded localities as in gardens and cultivated grounds the bands tend to be retained and become more accentuated, and it is also in those places that the largest shells are found.

It is a species which accurately reflects the features of its environment, and is especially organized to resist great heat and prolonged drought, the shell, especially abroad, being most frequently of a dull uniform creamy colour, adapted to resist the absorption of the heat to which it may be subjected.

On the Atlantic slope of Morocco the shells become more globose and solid with thicker lips, the markings are more brightly coloured, and display new arrangements testifying to the unusual features of their environment, and it is interesting to observe that M. Pallary ascribes the albinism of this species in Morocco to excess of humidity.

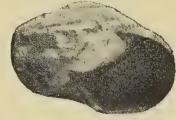


FIG. 422. — *Helix pisana* var. *biangulata*.
Tunis (M. G. de Kerville).
(after Dr. Germain).



FIG. 423. — *Helix pisana* Müller, × 1½.
Tenby, Mr. J. R. B. Masefield.
Showing abrupt commencement of distinct banding.

Var. *globosior* Shuttleworth.

VARIATIONS OF FORM.

- Helix pisana* var. *globosior* Shuttleworth, Moll. Corse, 1843, p. 15.
Helix pisana var. *globosa* Requier, Catal. 1848, p. 44.
Helix carpiensis and *hamadanica* Let. et Bourg., Prodr. Mal. Tunis., 1887, p. 86.
Helix donatii Berthier, Prodr. Mal. Tunis., 1887, p. 82.
Helix dermoi Servain, Prodr. Mal. Tunis., 1887, p. 85.
Helix radesiana Maré, Prodr. Mal. Tunis., 1887, p. 85.
Helix lenoleuca Bourguignat, Prodr. Mal. Tunis., 1887, p. 80.
Helix (Euparypha) pisana var. *ægusina* Mont., Moll. isole adj. Sicilia, 1892, p. 15.
Helix pisana var. *globulosa* Locard, Conch. Portug., 1899, p. 50.
Helix pisana var. *donnelli* Pallary, Journ. de Conch., 1904, p. 52, p. 11, pl. 2, f. 12.
Helix pisana var. *gratiosa* Monterosato, MS.

SHELL more globular.

The sub-var. *ægusina* is described as globose, but is also often found in a small form, described by M. di Monterosato as *minima globosa*, which is only 14 mill. in diameter and 11 mill. in altitude.

The sub-var. **donnelli** is described as large and very globose, with a large well-rounded aperture and a covered umbilicus. It approximates to *H. djerbanica* in form, but the whorls are not carinate, nor the body-whorl subangular.

Diam., 20-21 mill.; alt., 16-18 mill.

The sub-var. **radesiana** is globose in shape, with six moderately convex whorls, and an elevated spire. Differs from sub-var. *pisanopsis* by its more globose form, more conoid spire, and its smaller and flatter last whorl. Diam. 13-18 mill.; alt. 12-16 mill. (See Monogr., pl. xxxi., ff. 4, 5). The variegated colouring of the illustrative figure is not a distinctive feature, as type shells in the Muséum d'Histoire Naturelle, Paris, are of a uniform whitish colour.

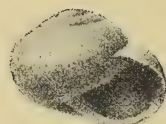


FIG. 421.—*Helix pisana* sub-var. *donnelli* Pallary.
Tetuan (after Pallary).

The sub-var. **carpiensis** is closely related to sub-var. *radesiana*, but is less globose with a less elevated spire and a less swollen body whorl. Diam. 15 mill.; alt. 12 mill. (See Monogr., pl. xxxi., f. 21). The colouring of the illustrative figure is not one of the characters of this form, which may also be quite bandless.

The sub-var. **donatii** is described as depressly tectiform, spire conoid, composed of six convex whorls, the last large and angulated at the periphery; said to differ from the typical form by its smaller size, its median keel, and smaller aperture. Diam. 18 mill.; alt. 14 mill. (See Monogr., pl. xxxi., f. 20).

The sub-var. **dermoi** is globosely elevated, the spire composed of six convex whorls, the last rounded. Diam. 15 mill.; alt. 12 mill. (See Monogr., pl. xxxi., ff. 7, 8). The figures show a form somewhat more depressed than usual, and the colouring is also only one of the forms this variety assumes.

The sub-var. **hamadanica** is described as globose in form, with large body-whorls, and somewhat elate spire; the colouring is of a dull whitish or rosy hue, with yellowish banding, or may be speckled with black. Diam. 14 mill.; alt. 12 mill.

The sub-var. **gratiosa** is described as very globose and whitish in colour, with a few interrupted and pale brown spirally revolving bands above and below.

Diam. 13 mill.; alt. 11 mill. (See Monogr., pl. xxxi., f. 9).

The sub-var. **lenoleuca** has neither been described nor figured.

The *Helix carpiensis*, *Helix hamadanica* and *Helix pisanopsis* of Let. & Bourg., *Helix lenoleuca* Bourg., *Helix radesiana* Marès, and *Helix dermoi* are classed as globular or spheroidal, with rounded whorls by MM. Letourneux and Bourguignat.

Dr. Germain, who has especially studied *Helix pisana*, as a result of his own examinations, enumerates as of globose or normal form, *H. bocagei*, *H. djerbanica*, *H. radesiana*, *H. carpiensis*, and *H. donatii*, and classing *H. hamadanica* and *H. dermoi* as belonging to the elate section.

It is described by Dr. Germain as rather common and widely diffused, the south of France, Spain, Portugal, Corsica, Algeria, Tunis, etc., being enumerated.

Pembroke—Not common, Marsh road, Tenby, A. G. Stubbs.

WALES.

FOREIGN DISTRIBUTION.

France—Var. *globosior* was described from Corsica by Mr. Shuttleworth. Sub-var. *carpiensis* is recorded from Rochelle, Charente Inférieure; Toulon, Var; and in Corsica was found by Comm. Caziot at an altitude of nearly 1,800 feet upon Rhætian and Serpentine rocks on the Col de Zeghime near Bastia.

Spain—Sub-var. *carpiensis*, Barcelona! G. K. Gude. Sub-var. *donatii* is recorded from Cadiz, and sub-var. *dermoi* from Seville.

Portugal—Sub-var. *carpiensis* is reported from Coimbra; sub-var. *radesiana* from Oporto; and sub-var. *donatii* from Oporto and Faro.

Italy—Sub-var. *carpiensis*, Terracena, Rome! G. K. Gude. Sub-var. *donatii*, Lido, Venetia! P. Dautzenberg. Sub-var. *agusina* and its dwarf variety, Isle of Favignana, Sicily; and sub-var. *gratiosa*, Quarto, Sardinia! Marquis Monterosato.

Morocco—Reported by Mr. J. Cordukes. The sub-vars. *dermoi* and *radesiana* are recorded from Tetuan, and sub-var. *donnelli* as abundant there (Pallary, l.c.). Sub-var. *carpiensis*, Mogador! G. K. Gude.

M. Morelet also describes and figures specimens found on the banks of Oued Tydal, twenty-four miles south of Mogador, which have been identified by MM. Letourneux and Bourguignat as representing *Helix dermoi*; the same authorities

identified as *Helix radesiana* M. Morelet's figures of a persistent racial variety found at Tézaroualt, province of Sous, which is said by them to be well distributed in South Morocco.

Algeria—Recorded from Bône and Constantine by Bourguignat. Sub-vars. *dermoi* and *radesiana* are quoted from Algeria by M. Pallary.

Tunis—Golita near Tunis, Sept. 1884 ! Capt. E. F. Becher. Sub-var. *carpiensis*, Golita ! G. K. Gude ; and cited for the hills near Hammam-el-Lif by M. Letourneux. Sub-var. *hamadanica* is cited by Letourneux and Bourguignat from the Hamada district, and from about Hammam-el-Lif and Gabes ; sub-var. *donatii* from Tozer ; and sub-vars. *dermoi* and *radesiana* from Radès between Tunis and Hammam-el-Lif.

Egypt—Letourneux and Bourguignat record sub-var. *lenoleuca* from Egypt.

Asia Minor—Letourneux and Bourguignat record sub-var. *lenoleuca* from Syria ; sub-var. *donatii* from Jaffa ; sub-var. *carpiensis* from Beyrouth ; and sub-var. *hamadanica* from Famagousta, Cyprus.

Var. *subconica* Monterosato.

Helix (Euparypha) pisana var. *subconica* Monts., Moll. isole adj. Sicilia, 1892, p. 16.

Helix chambardi Letourneux in Prodr. Mal. Tunisie, 1887, p. 82.

Helix byrsæ Marès, op. cit., 1887, p. 81.

Helix couturieri and *thinophila* Bourguignat, op. cit., 1887, pp. 79, 80.

Helix pisana var. *alta* Locard, Conch. Portug., 1899, p. 50.

Helix pisana var. *dissimulans* Monterosato, MS.

The var. *subconica* is described as a small shell, with conically-produced spire, and a slight angulation at the periphery. Diam. 14 mill. ; alt. 13 mill.

The typical var. *subconica* though not showing nearly so high a coefficient as the sub-vars. *alta* and *chambardi*, is in appearance much more conoid, due chiefly to the much more depressed and rounded whorls, which gives a greater apparent height to the shell.

M. di Monterosato cites without description sub-vars. *subalbida* and *sublineata*.

The sub-var. *byrsæ* is described as subconically globose, body whorl large and slowly descending. Diam. 15 mill. ; alt. 13 mill.

The sub-var. *dissimulans* Monterosato is described as solid, cretaceous, and of a dull whitish colour, spire conoid and elate, body whorls spheroidal.

Diam. 16 mill. ; alt. 14 mill. (See Monogr., pl. xxxi., f. 6).

The sub-var. *alta* is described by Dr. Germain as characterized by a very elevated spire, and figured as attaining an altitude of 21 mill., with a diameter of 23 mill.

The sub-var. *chambardi* varies much in size and colouring, but has a small conoid shell of six or seven convex whorls, the body whorl is of medium size and slopingly rounded. Typical shells are 11 mill. in diam., and 10 mill. in alt.

The sub-vars. *couturieri* and *thinophila* have never been described or figured.

The *Helix couturieri* and *thinophila* of Bourguignat, *Helix byrsæ* of Marès, and *Helix chambardi* of Letourneux, are classified as conoid shells with elevated spires by Letourneux, Bourguignat, and Germain.

WALES.

Pembroke—Var. *subconica*, north side of Castle Hill, Tenby ! and sub-var. *alta*, Tenby ! A. G. Stubbs.

FOREIGN DISTRIBUTION.

France—Sub-var. *alta*, La Rochelle, Charente Inférieure (Coll. Locard, Mus. d'Hist. Nat., Paris). Grasse, Alpes Maritimes ! Hugh Watson.

Austro-Hungary—Sub-var. *chambardi*, Istria (Let. & Bourg., op. cit.).

Italy—Var. *subconica* and sub-vars. *subalbida* and *sublineata*, upon rushes and Oleanders on the sandy coast, Mondello near Palermo, and on the Isle of Favignana ; and sub-var. *dissimulans* from the dunes at Messina, Sicily, Marquis Monterosato. Sub-var. *chambardi* is cited for Italy by Letourneux and Bourguignat.

Portugal—Sub-var. *alta* (Locard, l.c.).



FIG. 425.—*Helix pisana* var. *subconica* Monts.
Mondello, Sicily (Marquis Monterosato).

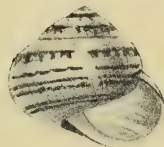


FIG. 426.—*Helix pisana* sub-var. *alta* Locard.
Rochelle, France.
(Mus. Hist. Nat. Paris).

Morocco—Mogador, collected by Lieut.-Col. Parry ! G. K. Gude.

Algeria—Sub-var. *alta*, Algiers (Coll. Locard, Mus. d'Hist. Nat., Paris). Sub-var. *couturierii*, Algeria (Let. & Bourg., op. cit.).

Tunis—Sub-var. *alta*, rather rare, Khroumirie (Germain, l.c.). A large form of sub-var. *chambardi* (var. *maxima* Let. & Bourg.), is recorded from Radès, and sub-var. *byrsce* from Radès near the mouth of the Oued Meliana and among the ruins of Carthage (Let. & Bourg., op. cit.).

Egypt—Sub-var. *thinophila*, Egypt, and sub-var. *chambardi*, dunes of Ramleh near Alexandria (Let. & Bourg., op. cit.).

Madeira—Little Salvage, T. V. Wollaston ! J. Cosmo Melvill.

Azores—Specimens labelled "var. *trochiforme* Furtado, St. Michael," and received from d'Arruda Furtado, are in the collection of Leeds Philosophical Society.

Var. *depressa* Requien.

Helix pisana var. *depressa* Requien, Cat. Moll. Corse, 1848, p. 44.

Helix pisanella and *olivaresi* Servain, Prodr. Mal. Tunis, 1887, pp. 80, 83.

Helix cuttati Bourguignat, op. cit., 1887, p. 80.

Helix monroi, *gergisensis* and *salemensis* Let. et Bgt., op. cit., p. 84.

Helix levesquei Berthier, op. cit., pp. 80, 83.

Helix barbozana Locard, Conch. Portug., 1887, p. 52.

Helix pisana var. *lata* Monterosato, ms.

The var. *depressa* is described as more depressed, periphery slightly angulate.

This may be the *Carocolla maculata* of Menke, which is described as depressed and more or less carinate, and has been considered as a variety of *H. pisana*.

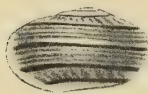


FIG. 427.



FIG. 428



FIG. 429.



FIG. 430.

FIG. 427.—*Helix pisana* var. *depressa* Req., Tenby, South Wales, Mr. A. G. Stubbs.

FIG. 428.—*Helix pisana* sub-var. *lata* Monts., Ascoli-Piceno, Italy, Marquis Monterosato.

FIG. 429.—*Helix pisana* sub-var. *barbozana* Locard, Nîmes, Gard (Mus. Hist. Nat. Paris).

FIG. 430.—*Helix pisana* sub-var. *monroi* Let. et Bourg., Limoux, Aude (Mus. Hist. Nat. Paris).

The sub-var. *lata* may be described as uniformly whitish in colour, large, and depressed, with body-whorl laterally expanded. Diam. 24 mill.; alt. 16 mill.

This variety has been assumed to be probably identical with the *H. alibrandi* of Rigacci (Catal., 1874, no. 2649) recorded from Civita Vecchia near Rome.

The sub-var. *pisanella* is the most depressed form, with a large ultimate whorl, and the angulation placed somewhat high on the whorl. Diam. 15-18 mill.; alt. 10-11 mill. (See Monogr., pl. xxxi., f. 15). This form is very variable and may be variously banded or bandless with a whitish or yellowish ground tint.

The sub-var. *barbozana* has been described as differing chiefly from the type in its more depressed spire. It may be uniformly whitish or variously banded.

The sub-var. *salemensis* is described as a well depressed and solid shell with a large and angulate body whorl. Diam. 17 mill.; alt. 11 mill.

The sub-var. *levesquei* is of a depressed shape, opaque, and cretaceous, with a peripheral angulation. Diam. 16 mill.; alt. 10½ mill.

The sub-var. *monroi* is closely related to sub-var. *cuttati*, but is more convex, and the last whorl is more distinctly keeled.

The sub-var. *cuttati* is depressed in shape, with a very median angulation, and is often uniformly whitish in colour, but is also variously banded and even albine (See Monogr., pl. xxxi., f. 14).

The sub-var. *gergisensis*, though somewhat globose, has a depressed spire, and the body whorl angulate. The swollen body whorl separates it from the sub-var. *salemensis*. Diam. 18 mill.; alt. 13 mill.

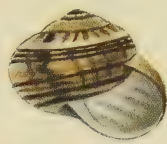
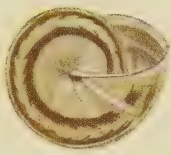
The sub-var. *olivaresi* has never been described or figured.

MM. Letourneux and Bourguignat arrange the depressed Tunisian forms of the species in three groups or series:

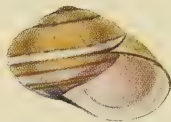
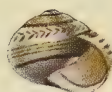
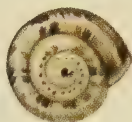
Helix pisanella, *H. levesquei*, *H. salemensis*, and *H. gergisensis* are classed as very depressed and carinate forms with ample ultimate whorls.

Helix subpisana, *H. agaroï* and *H. olivaresi* as depressed with ample body whorls.

HELIX PISANA Müller.



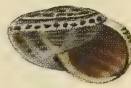
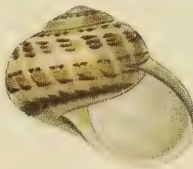
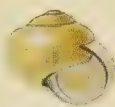
1-3. *Helix (Euparypha) pisana* Linné.
Tenby, A. G. Stubbs.



4. *H. pisana* var. *picta* Taylor.
Tenby, A. G. Stubbs.

5. *H. pisana* var. *dentata* Taylor,
Mogador, G. K. Gude.

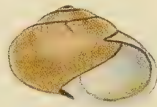
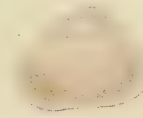
6. *H. pisana* var. *semifulva* Taylor.
Mogador, G. K. Gude.



7. *H. pisana* var. *tenuis* Taylor.
Tenby, J. W. Storey.

8. *H. pisana* s.-v. *magnifica* Monts.
Viareggio, Marquis Monterosato.

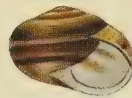
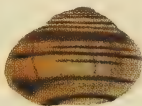
9. *H. pisana* var. *grasseti* Tarnier.
Las Palmas, Canary Islands.



10. *H. pisana* var. *diaphana* Bourg.
Tenby, A. G. Stubbs.

11. *H. pisana* var. *rosea* Costa.
Golita, Tunis (Brit. Mus.).

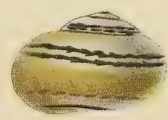
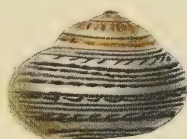
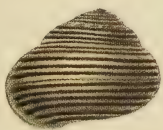
12. *H. pisana* var. *concolor* Moq.
Mogador, G. K. Gude.



13. *H. pisana* var. *ferruginea* Moq.
Golita, Tunis, G. K. Gude.

14. *H. pisana* s.-v. *adusta* Monts.
Tunis, Marquis Monterosato.

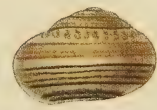
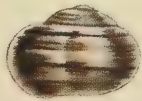
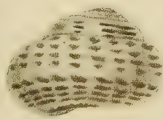
15. *H. pisana* var. *testudinea* Monts.
Chioggia, Marquis Monterosato.



16. *H. pisana* var. *lineolata* Moq.
Algiers, P. Dautzenberg.

17. *H. pisana* s.-v. *musica* Monts.
Palermo, Marquis Monterosato.

18. *H. pisana* s.-v. *bilineata* Monts.
Viareggio, Marquis Monterosato.



19. *H. pisana* s.-v. *punctella* Moq.
Algiers, P. Dautzenberg.

20. *H. pisana* var. *undulata* Taylor.
Golita, Tunis (Brit. Mus.).

21. *H. pisana* s.-v. *delicata* Monts.
Palermo, Marquis Monterosato.

As possessing convexly rounded spires with moderately developed but angulate body whorls, *Helix cuttati* and *H. monroi* are enumerated.

Helix tohenica and *Helix comaliana* are placed with the depressed forms by Letourneux and Bourguignat.

Dr. Paul Germain, who has so thoroughly studied the variation in this species, classifies as depressed forms

Helix agaroi, *H. levesquei*, *H. salemensis*, *H. barbozana*, and *H. pisanella*, and as merely subdepressed gives *Helix gergisensis*, *H. subpisana*, *H. cuttati*, *H. monroi*, and *H. machadoi*.

WALES.

Pembroke—Tenby, A. G. Stubbs.

FOREIGN DISTRIBUTION.

France—Bordeaux, Gironde, 1878 ! Dr. R. F. Scharff ; Toulon, Var ! G. K. Gude ; Cape Breton, Landes, and Grasse, Alpes Maritimes, Hugh Watson ; Nice, Alpes Maritimes ! P. Dautzenberg ; and recorded from Corsica by Dr. J. C. Grateloup. Sub-var. *pisanella* is known from Nîmes, Gard ; Sanary, and Ste-Baume, Var ; Les Martignes, and Marseilles, Bouches-du-Rhône ; and Nice. Sub-var. *barbozana*, Nîmes, Gard ; and sub-var. *monroi*, Limoux, Aude ! Dr. Germain. Sub-vars. *cuttati* and *monroi*, Provence (Let. & Bgt., op. cit.). Sub-var. *cuttati*, Sanary, Var ; Les Sables d'Olonne, Vendée, Marseilles and Rochelle, Dr. Germain.

Spain—Gibraltar ! R. D. Darbishire. Sub-vars. *cuttati*, *monroi*, and *olivaresi*, Spain. Sub-var. *pisanella*, Cadiz, Prof. Hidalgo ; abundant about Valencia ; near Seville, Andalusia ; and in the Balearic Isles (Letourneux & Bourguignat, op. cit.).

Portugal—Sub-var. *pisanella* is known from Lisbon, Coimbra, Oporto, Faro and Villa Nova de Milfontes. Sub-var. *cuttati* from Lisbon and Faro. Sub-var. *monroi* from Lisbon, Dr. Germain. Sub-var. *barbozana*, Lisbon and Oporto, Dr. Hidalgo.

Italy—Ventimiglia, Liguria ! P. Dautzenberg. Sandy coast at Mondello near Palermo, Sicily, Marquis Monterosato ; and Malta, A. Issel. Sub-var. *lata*, Ascoli-Piceno, Marches ! Marquis Monterosato.

Austro-Hungary—Sub-var. *cuttati*, Istria (Let. & Bourg., op. cit.).

Algeria—Sub-var. *levesquei* is cited for Algeria and sub-var. *pisanella* as quite typical in the Valley of the Seybouse near Bône (Let. & Bourg., op. cit.).

Tunis—Common nearly everywhere, Khroumirie (Germain, l.c.). Sub-var. *pisanella*, on the littoral dunes between Sfax and Gabes. Sub-var. *levesquei* on the dunes south of Gabes ; and sub-vars. *salemensis* and *gergisensis* at Sidi-Salein near Houmt-Souk, Island of Djerba, and environs of Zarzis (Let. & Bourg., op. cit.).

Canary Islands—Sub-var. *pisanella*, Grand Canary, G. K. Gude.

Somaliland—Sub-vars. *comaliana* and *tohenica* are recorded by Bourguignat.

Var. *grasseti* Tarnier.

Helix grasseti Tarnier, in Mousson's Revis. Mal. Canar., 1871, p. 31, pl. 2, ff. 33, 34.

The var. *grasseti* has the spire almost flat, the periphery angulated, but rounded at the aperture, and the umbilicus almost closed. (See Monogr., pl. xxx., f. 9).

It is authoritatively figured in the new edition of Martini und Chemnitz's Conchylien-Cabinet, *Helix*, pl. 37, ff. 5-8.

It is in part the *Helix planata* of Webb and Berthelot ; and is said—probably in error—to be identical with *Helix pisanoides* d'Orb., a native of the West Indies.

The var. *grasseti* is so striking a form that it has been detached from the var. *depressa* to which group it belongs so that its peculiarities may be emphasized, as it undoubtedly indicates a weaker and more ancient form of the species, although its peculiarities may have been accentuated by the submontane character of its habitats. Whether it may prove to be now sufficiently distinct to be regarded as a separate species must await a comparative study of its organization.

It is a form which varies very little, and in Grand Canary, according to Capt. Farrer, always lives apart from the typical *pisana*, being practically confined to the highlands and to the topmost ridges of the barrancos, and is never found naturally below an altitude of 400 feet, except on the Isleta, where the typical *pisana* does not exist. The var. *grasseti* is always found feeding on the *Euphorbia balsamifera*, while the typical *pisana*, which is exceedingly variable, swarms in the gardens, etc., feeding mostly on the Aloe (*Agave americana*) and the Prickly Pear (*Opuntia dillenii*) near the sea level, and is never found more than 100 feet above it, although a flourishing colony, evidently artificially introduced, lives on the Palms in the gardens of Ste. Brigida Hotel, Monte, at an elevation of 1,150 feet above the sea.

FOREIGN DISTRIBUTION.

Canary Islands—Var. *grasseti*, found in the north of Lanzarote, also recent and as a holocene fossil on Fuerteventura, T. Vernon Wollaston ! J. Cosmo Melvill. On Grand Canary it was abundant in the garden of Santa Catalina Hotel, Las Palmas, in March 1901 ! J. W. Taylor. Plentiful on the mountain sides and the topmost ridges of the barrancos about Las Palmas ! W. J. Farrer.

VARIATIONS IN SUBSTANCE.

Var. *djerbanica* Letourneux & Bourguignat.

Helix djerbanica and *zitanensis*, Let. et Bgt., Prodr. Mal. Tunis., 1887, pp. 86, 87.

SHELL described as thick, opaque, and ponderous, usually dull yellowish, or with a slightly rosy tinge, spire convex, body-whorl large and slightly angulated. Diam. 17-21 mill.; alt. 13-17 mill. (See Monogr., pl. xxxi., f. 18).

The sub-var. *zitanensis* is described as uniformly pinkish-white, globosely tumid, thick and heavy shelled, with convex spire, rounded body-whorl, and a large and expanded mouth, with pearly interior. Diam. 17 mill.; alt. 15 mill.

FOREIGN DISTRIBUTION.

Portugal—Var. *djerbanica* is reported from Lisbon, Oporto, Coimbra, Faro, and Sernache, by Prof. Hidalgo.

Tunis—Var. *djerbanica* is recorded from Houmt-Souk in the Isle of Djerba, from the environs of Zarzis, and the regions of Hamada. Sub-var. *zitanensis* is found on the Hill of Medinet-Zian, near Zarzis (Let. & Bgt., op. cit.).

Var. *tenuis* Taylor, Journ. of Conch., Oct. 1890, vol. vi., p. 281.

Helix pisana var. *delicata* Monterosato MS.

The var. *tenuis* has the shell very thin, and about four grains in weight. (See Monogr., pl. xxx., f. 7).

The sub-var. *delicata* is described as delicate in texture, of a whitish colour, with broad sienna banding overlaid by black lineolation. (See Monogr., pl. xxx., f. 21).

WALES.

Pembroke—Tenby, 1890 ! J. W. Storey, A. G. Stubbs, and Rev. J. W. Horsley.

CONTINENTAL DISTRIBUTION.

France—Sub-var. *delicata*, dunes d'Escoubiac-la-Baule, Deauville, Calvados ! Ph. Dautzenberg; and Moquin-Tandon records excessively thin shells from the coast at Calvi, Corsica.

Sicily—Sub-var. *delicata*, Palermo ! Marquis Monterosato.

Morocco—Sub-var. *delicata*, Morocco, J. Cosmo Melvill.

Canary Islands—Sub-var. *delicata*, Las Palmas, 1906 ! Capt. W. J. Farrer.

VARIATIONS IN SIZE.

Var. *magna* Rossm., Iconog., 1839, pl. 47, f. 614.

Helix pisana var. *spheroidea* Westerlund, Moll. Extram., 1878, p. 92.

Helix chambari var. *maxima* Letourn. et Bourg., op. cit., p. 82, 1887.

Helix pisana var. *major* Locard, Conch. Portug., 1899, p. 50.

Helix pisana vars. *magnifica*, *ampla*, and *irregularis* Monterosato, MS.

SHELL much larger. The var. *magna* is figured by Prof. Rossmässler as more than 27 mill. in diameter. (See Monogr., vol. i., frontispiece, fig. 7).

It is also the var. *spheroidea* of Westerlund, described as larger and more spheroidal, and as represented in Rossmässler's Iconog. by f. 614, but this figure represents a very large shell of ordinary form, and is typical of var. *magna* Rossm.

The sub-var. *ampla* is described as a large and somewhat solid shell, of a whitish colour, with diverse and varied black or fuscous bandings, or may be of a pallid hue with the lip tinged with rose.

Diam. 25 mill.; alt. 18 mill.

The sub-var. *magnifica* is described as large, and somewhat thin, of a whitish colour, with many slender ochreous and black bands disposed in groups and broken up into rhomboidal blocks by radiately arranged whitish areas. Diam. 24 mill.; alt. 20 mill. (See Monogr., pl. xxx., f. 8).

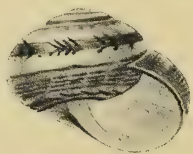


FIG. 431.—*Helix pisana* sub-var. *ampla* Monts.

Garden, S. Susanna, Rome.
(Marquis Monterosato).

The sub-var. **major** is described as one-third larger than the type.

The sub-var. **maxima** is described as a large form of sub-var. *chambardi* and as measuring 20-22 mill. in diameter and 16-19 mill. in altitude.

The sub-var. **irregularis** is described as irregularly grown, somewhat gibbous, and with finely malleate ultimate whorl. Diam. 25 mill.; alt. 15 mill. Though this form is really a somewhat irregularly grown shell, it is perhaps more suitably dealt with here than under a separate heading.

ENGLAND AND WALES.

Channel Isles—Grève d'Azette, Jersey, 1905 ! F. H. Sikes.

Pembroke—Found at the Wreck-field, Ritec Gardens, and South Cliff, Tenby, by Mr. A. G. Stubbs, and extraordinarily large specimens were found in a cabbage garden near the Wreck Field by Mr. Fred. Taylor.

FOREIGN DISTRIBUTION.

France—Var. *magna*, Dax, Landes (Hartmann, Gasterop. Schweiz, 1844, p. 210). Grasse, Hugh Watson; banks of R. Rance, Ille-et-Vilaine (H. Leslie, Sci. Goss., Nov. 1871, p. 245). Sub-var. *magnifica*, Nice, Alpes Maritimes ! P. Dautzenberg.

Italy—Var. *magna*, Corneto, Rome ! G. K. Gude, and Ventimiglio, Liguria ! P. Dautzenberg. Sub-var. *magnifica*, in garden of Dr. del Prete, Viareggio, near Pisa, Tuscany ! Sub-var. *hortensis*, vegetable gardens, now destroyed, at S. Susanna, Rome ! and sub-var. *irregularis*, Girgenti, Sicily ! Marquis Monterosato.

Portugal—Var. *major*, rather common (Locard, l.c.).

Algeria—Var. *magna*, Algiers ! P. Dautzenberg.

Tunis—Var. *maxima*, Radès (Let. & Bourg., op. cit.); and sub-var. *major*, rather common, Khroumirie (Germain, l.c.).

Egypt—Var. *maxima*, dunes of Ramleh, nr. Alexandria (Let. & Bourg., op. cit.).

Var. *minor* Bourguignat.

Helix pisana var. *minor* Bourguignat, Mal. Alger., 1864, i., p. 237.

Helix pisana var. *sardoa* Westerlund, Moll. Extram., 1878, p. 92.

Helix pisana var. *thusurosi* Letourn. et Bourg., Prodr. Mal. Tunis., 1887, p. 81.

Helix pisana var. *subplanata* Pallary, Compte Rendu, 1900, vol. 29, p. 731, pl. 11, f. 4.

SHELL smaller; diam. 13 mill.; altitude 9 mill.

The *Euparypha pisana* var. *parvula* Mousson, from Fuerteventura, Canary Islands, is probably identical.

The sub-var. **sardoa** of Ziegler is described by Westerlund as small, with partially closed umbilicus, and continuous and interrupted banding. Diam. 12-13 mill.; alt. 9 mill. The description of the same variety given by Moquin-Tandon "whitish, with continuous and interrupted brown bands" is brief and even less precise.

The sub-var. **thusurosi** (*Helix thusurosi* Bourg. olim) is identical in size with the var. *minor*, and has a narrow umbilicus, a thin, transparent and whitish shell, with a very large body-whorl, slightly angulate at its origin.

The sub-var. **subplanata** is described as a shell possessing a depressed spire, with carinate penultimate and body-whorl, and a more elongate aperture. The illustrative figure here reproduced shows a shell measuring $13\frac{1}{2}$ mill. in diam. and 10 mill. in alt.

This variety scarcely possesses sufficient individuality to entitle it to a distinctive name, and may perhaps be more suitably placed under the var. *minor* on account of its diminutive size than with the depressed forms as probably intended by the author.

ENGLAND AND WALES.

Channel Isles—Vazon Bay, Guernsey, with typical specimens (Tomlin and Marquand, Journ. of Conch., vol. x., p. 289).

Pembroke—Tenby, 1886 ! C. Jefferys. Common on the Burrows near high-water mark, and in the Jubilee Gardens and South Cliff, Tenby, also on the cliffs near Lydstep, A. G. Stubbs.

FOREIGN DISTRIBUTION.

France—Cannes, Alpes Maritimes, Dr. Battersby; and is recorded by Moquin-Tandon from Montpellier, Hérault. Sub-var. *sardoa*, Marseilles, J. R. le B. Tomlin.

Italy—Sub-var. *sardoa*, recorded and named from Sardinian specimens.

Spain—Gibraltar ! R. D. Darbishire. Very small specimens (the var. *minima* of Horsley) found at Malaga, Andalusia, by Rev. J. W. Horsley.



FIG. 432.—*H. pisana* var. *minor*, Tenby, Mr. A. G. Stubbs.

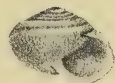


FIG. 433.—*H. pisana* var. *subplanata* Pall. Camerata, Tunis. (after Pallary).

Portugal—Var. *minor*, rather common almost everywhere (Locard, l.c.); and sub-var. *thusurosi*, Cascaes (Letourn. & Bourg., l.c.).

Algeria—Sprinkled about throughout Algeria; and sub-var. *sardoa*, Algiers and Oran (Bourguignat, l.c.); also Hussein Dey near Algiers ! A. Shaw.

Tunis—Var. *minor*, rather common, Khroumirie, P. Germain. Sub-var. *thusurosi*, environs of Tozer (Let. & Bourg., op. cit.). Sub-var. *subplanata*, shores of Camerata, near Beni-Saf (Germain, l.c.).

Syria—Sub-var. *thusurosi*, Beyrout (Let. & Bourg., op. cit.).

Var. dentata Taylor, var. nov. (Monogr., pl. xxx., f. 5).

SHELL with a distinct tubercle on the parietal wall.

This is a very remarkable shell, reproducing in adult life the parietal denticle temporarily characterizing the juvenile form named *Helix catocyphia* by Bourguignat, and linking the species with *H. subdentata*.

FOREIGN DISTRIBUTION.

Morocco—Mogador, collected by Lieut.-Col. Parry ! G. K. Gude.

VARIATIONS IN COLOUR OF SHELL.

Var. alba Moquin-Tandon.

Helix pisana var. *alba* Moquin-Tandon, Hist. Moll., 1855, ii., p. 260.

Helix pisana var. *albina* Grateloup, Catal. Moll. Fr., 1855, p. 9.

Helix pisana var. *albinos* Bourguignat, Mal. Alger., 1864, i., p. 237.

Helix pisana omnino alba Lallemand, Mal. Alg., 1868, p. 37.

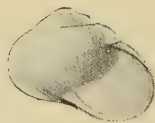
SHELL pure white, without transparent banding.

The sub-vars. *albinos* Bourg. and *omnino alba* Lallemand are uniformly white.

The sub-var. *bertini* is an albine form of somewhat globose shape, with a moderately elevated spire. Diam. 20 mill.; alt. 15 mill.

The var. *alba* of Jeffreys includes the translucent banded variety (*diaphana*), and also confuses together the var. *albida* with the unbanded albine form.

FIG. 434.—*Helix pisana* sub-var. *bertini* Loc., Rians, Var. (Coll. Mus. Hist. Nat. Paris).



ENGLAND AND WALES.

Channel Isles—St. Clement's Bay, Jersey, Sept. 1911 ! W. Cash. Guernsey, at Bordeaux Harbour, 1887, J. R. le Brockton Tomlin; Grève d'Azette, June 1905 ! F. H. Sikes. Vazon Bay and St. Sampson Bay ! J. E. Cooper.

Cornwall W.—Specimens in the British Museum, labelled "*H. pisana* var., Falmouth," T. D. A. Cockerell.

Pembroke—Tenby, rare, South Cliff beneath Esplanade, in Jubilee Gardens, and on railway-bank, beyond the Wreck-field (Stubbs, J. of Conch., vol. ix., p. 327).

IRELAND.

Louth—Drogheda and Clogher, Sept. 1904 ! P. H. Grierson.

Meath—Julianstown, June 1904 ! Dr. R. F. Scharff.

Dublin—Common on sandhills, Rush, Sept. 1885 ! J. R. Redding.

FOREIGN DISTRIBUTION.

France—Recorded from Mentone, Alpes Maritimes, by A. G. Stubbs; from Chaussey Isles, Manche, by F. H. Sikes; from near Brest, Finistère, by F. Daniel; from Montpellier, Lunel, Béziers, and Lodève, Hérault, by Dubrueil; from Prairies du Vistre, Gard, by Clement; with a sub-pellucid shell from Quibéron and Belle-Île, Morbihan, by Mabille; Bordeaux, Gironde, by Dr. Scharff; and from Corsica by Dr. Grateloup. A specimen of a form labelled *H. bertini* Locard, from Rians, Var, is in the Muséum d'Histoire Naturelle, Paris.

Italy—Genoa, Liguria ! Civita Vecchia, Rome; and Girgenti, Sicily ! G. K. Gude.

Spain—Galicia, Dr. Macho; San Sebastian, Basque Provinces ! Prof. J. G. Hidalgo.

Morocco—Reported from Morocco by Mr. J. H. Ponsonby; and also mentioned by M. Pallary, who attributes its occurrence in Morocco to excess of humidity.

Algeria—Var. *albinos* recorded from Oran, Mostaghenem, Algiers, Bône, etc.

Egypt—Suez ! P. Dautzenberg.

Syria—Jaffa, March 1904 ! F. H. Sikes.

Var. *albida* Moquin-Tandon.*Helix pisana* var. *albida* Moquin-Tandon, Hist. Moll. Fr., vol. ii., 1855, p. 260.*Helix agaroi* Servain, Prodr. Mal. Tunis., 1887, p. 80.*Helix bocagei* Locard, Conch. Portug., 1899, p. 51.*Helix pisana* sub-var. *thalassophila* Monterosato, MS.

SHELL dull whitish, with the lip and parietal wall of a creamy or brownish tint.

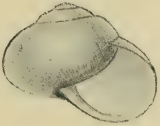
The var. *alba* of Shuttleworth (Moll. Corse, 1843, p. 15), described as "entirely whitish or very pale yellowish" would appear to embrace the vars. *concolor* and *albida*.The var. *alba* of Jeffreys, as described by that author (Brit. Conch., 1862, vol. i., p. 208) also includes this variety, as well as the albine form.

FIG. 435.

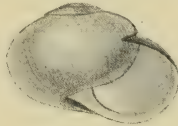


FIG. 436.

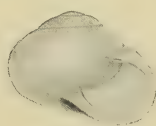


FIG. 437.

FIG. 435.—*Helix pisana* sub-var. *bocagei* Locard, Lisbon (Mus. Hist. Nat. Paris).FIG. 436.—*Helix pisana* sub-var. *thalassophila* Monts., Palermo, Sicily, Marquis Monterosato.FIG. 437.—*Helix pisana* sub-var. *agaroi*, Let. & Bourgt., Lisbon (Mus. Hist. Nat. Paris).The sub-var. *bocagei* is subdepressed, with a broadly conical spire, and is of an uniformly whitish colour. Diam. 20 mill.; alt. 15 mill.The sub-var. *thalassophila* is described as subconoidal and somewhat solid, of an uniform whitish colour, sometimes with a rosy lip. Diam. 19 mill.; alt. 14 mill.The sub-var. *agaroi* is subdepressed, with a very slightly risen spire, and very ample last whorl. It is usually uniformly whitish. Diam. 20 mill.; alt. 15 mill. It differs from sub-var. *subpisana* in its more compact shape, larger, loftier, and more sloping last whorl, and indistinctly rectangular profile.

ENGLAND AND WALES.

Channel Isles—In Guernsey it has been found on the sea-wall, Vazon Bay, by Mr. Hugh Wyndham, and recorded from Bordeaux Harbour and about Vale Castle (Tomlin and Marquand, Journ. of Conch., x., p. 289). Grève d'Azette, Jersey, 1905! F. H. Sikes.**Pembroke**—Common, Wreck field, Tenby! G. S. Tye. Common at Giltar, Caldy Island, and about Tenby, A. G. Stubbs.**Glamorgan**—Abundant on the Burrows, Swansea, 1874, R. Rimmer.

IRELAND.

Louth—Drogheda, 1904! P. H. Grierson.**Meath**—Julianstown, Dr. R. F. Scharff.**Dublin**—Sandhills, Rush, Sept. 1885! J. R. Redding.

FOREIGN DISTRIBUTION.

France—Grasse, Alpes Maritimes, Hugh Watson. Zamaris, Var; Rueil near Paris, Seine-et-Oise, 1902! and Roquefavour, Bouches-du-Rhône! P. Dautzenberg. Perpignan, Pyrénées Orientales! G. K. Gude. Cucuron, Vaucluse, J. R. le B. Tomlin. Recorded by Dubrueil from Montpellier, Lunel, Béziers, and Lodève, Hérault; and as var. *alba* from Corsica by Shuttleworth (Moll. Corse, 1843, p. 15).**Italy**—Lido, Venetia! P. Dautzenberg; and Girgenti, Sicily! G. K. Gude. Sub-var. *thalassophila*, Mondello, near Palermo, Marquis Monterosato.**Spain**—Toledo, New Castile! Rev. W. C. Hey; Barcelona, Lieut.-Col. Parry; Mahon, Balearic Isles! P. Dautzenberg; and Neutral ground, Gibraltar! R. D. Darbishire. Sub-var. *agaroi*, Spain (Let. & Bourg., op. cit.).**Portugal**—Sub-var. *agaroi*, Lisbon, Dr. Germain. Sub-var. *bocagei* is recorded from Oporto, Faro, and Lisbon by Prof. Hidalgo. The uniformly whitish variety is the dominant form in Portugal.**Madeira**—Porto Santo! G. K. Gude.**Azores**—Flores! G. K. Gude.**Morocco**—Tangiers! G. K. Gude.**Algeria**—Algiers! P. Dautzenberg.**Cape Colony**—Var. *albida* is one of the most abundant forms on Robben Island (Swanton, Journ. of Conch., vol. x., p. 194).

Var. *rosaceo-albida* Bourguignat.

Helix albina Ziegler, Pfeiffer, Mon. Hel. Viv., 1848, i., p. 153.

Helix pisana var. *albida* Benoit, Test. Estram. Sicilia, 1859, p. 128, pl. 3. f. 2.

Helix pisana var. *rosaceo-albida* Bourguignat, Mal. Alger., 1864, i., p. 237.

Helix pisana var. *roseola* Lallemand, Mal. Alger., 1868, p. 37.

Helix pisana var. *rosea* Costa, Bull. Mal. Ital., 1879, v., p. 30.

Helix subpisana Bourguignat, Prodr. Mal. Tunis, 1887, p. 84.

Helix machadoi Locard, Conch. Portug., 1887, p. 50.

Helix (Euparypha) pisana var. *rosalba* Monts., Moll. isole adj. Sicilia, 1892, p. 15.

Helix pisana var. *faux-rosea* Monterosato, MS.

The vars *roseaceo-albida* and *roseola* have the last whorl and inside the mouth of a rosy tint. (See Monogr., pl. xxx., f. 11).

The sub-var. *rosalba* is uniform rosy white, occasionally with a black basal band.

The sub-var. *faux-rosea* is restricted to those shells in which the rosy tint is confined to the interior of the aperture.

The var. *albida* Benoit is described as uniformly whitish, with a rosy mouth.

The sub-var. *rhadanica* Locard, judging from the single specimen seen, is of medium size, has a somewhat elevated spire, is of a whitish colour, with a still whiter peripheral line, and a rosy mouth. (See Monogr., pl. xxxi., f. 19).

The sub-var. *subpisana* is described as very ventricose, with a large and well rounded body whorl. Diam. 20 mill.; alt. 14 mill. It differs from the type by its more swollen shape, more depressed spire, and thicker shell. Usually with an uniformly whitish shell and pink aperture.

The sub-var. *machadoi* is described as a thin shell, with the spire more depressed than in sub-var. *barbozana*, and as having a more compressed last whorl. (See Monogr., pl. xxxi., f. 16). The figured shell is almost typical in form, but has a rosy mouth.

According to Dr. Pfeiffer, it is in part the *Helix albina* Zglr., described as white with a rosy or brownish mouth.

The rosy tinge inside and around the aperture of this variety and which sometimes also suffuses the shell generally, is probably most developed in localities with sunny aspects, but there would also seem to be some degree of correlation with the presence or absence of the spiral fasciation, as the rosy tinge is almost invariably most vivid on unbanded shells.

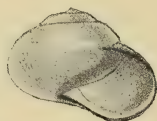


FIG. 438.—*Helix pisana* sub-var. *subpisana* Bourgt., Lisbon, Portugal.

(Coll. Mus. Hist. Nat. Paris).

ENGLAND AND WALES.

Channel Isles—The pink-lipped variety is, according to the observations of Mr. Tomlin, found intermingled with the ordinary form in Guernsey.

Glamorgan—Sand-hills, Swansea, 1884, E. Collier.

Pembroke—Fairly common on fennel and brambles in places exposed to the sun, on the South Cliff, etc; sub-var. *faux-rosea*, Marsh road, Tenby! A. G. Stubbs.

FOREIGN DISTRIBUTION.

France—Sub-var. *faux-rosea*, Perpignan, Pyrénées Orientales! G. K. Gude.

Italy—Dr. Hartmann records an entirely "rosy-red" specimen from Naples sent to him by Signor C. Porro. Var. *rosaceo-albida*, Pæstum, Campania, Mar. 1907, Miss Melvill. Sub-var. *rosea*, from banks of R. Tronto, Abruzzi (Valentini, Moll. Marches, 1879, p. 30). Sub-var. *rosalba*, Isle of Favignana, Sicily; and sub-var. *faux-rosea* from the beach at Salerno near Naples, and dunes, Viareggio, Tuscany, Marquis Monterosato. Sub-var. *albida* Benoit, Madonie, Sicily (Benoit, op. cit.).

Spain—Barcelona! and sub-var. *faux-rosea*, Palma, and Mahon, Balearic Isles, G. K. Gude. Sub-var. *subpisana*, near Seville and Minorca (Let. & Bgt., op. cit.).

Portugal—Sub-var. *rhadanica*, Oporto (Mus. d'Hist. Nat., Paris). Sub-var. *subvisana*, Lisbon, Oporto and Faro; and sub-var. *machadoi*, Lisbon and Faro, Hidalgo.

Austro-Hungary—Sub-var. *subpisana*, Istria (Let. & Bourg., op. cit.).

Morocco—Morelet records from near Mogador an uniformly rosy-flesh coloured form with a very bright carmine-tinted interior. Sub-var. *faux-rosea*, Morocco! Fred Booth.

Algeria—Var. *rosaceo-albida*, Bône, and Stora, M. Bourguignat; Mostaghanem! G. K. Gude. Sub-var. *roseola*, Algiers, M. Lallemand.

Tunis—Specimens with a pale pink ground color collected in 1846 on the banks of the R. Ghabs, Golita, near Tunis, are in the British Museum! Sub-var. *subpisana* in the environs of Tunis (Let. & Bourg., op. cit.).

Tripoli—Sub-var. *faux-rosea*, Tripoli, Dr. E. von Barry.

Egypt—Alexandria! G. K. Gude.

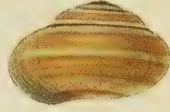
HELIX PISANA Müller.



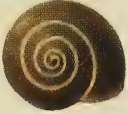
1. *H. pisana* s.-v. *subzonata* Bourg.
Tenby, A. G. Stubbs.



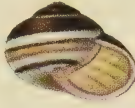
2. *H. pisana* s.-v. *aurea* Mont.
Girgenti, Marquis Monterosato.



3. *H. pisana* s.-v. *luteozonata* Bourg.
Balearic Is., Canon Horsley.



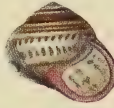
4, 5. *H. pisana* sub-var. *dermoi* Servain.
Oued Tydai, near Mogador (after Morelet).



6. *H. pisana* sub-var. *dissimulans* Monts.
Messina, Marquis Monterosato.



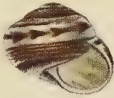
7, 8. *H. pisana* sub-var. *radesiana* Marés.
Tézaroualt, Morocco (after Morelet).



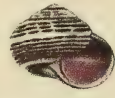
9. *H. pisana* sub-var. *gratiosa* Monts.
Sardinia, Marquis Monterosato.



10. *H. pisana* s.-v. *spirolineata* Mts.
Favignana, Marquis Monterosato.



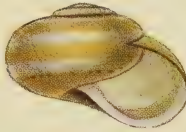
11. *H. pisana* s.-v. *sertum* Mts.
Favignana, Marquis Monterosato.



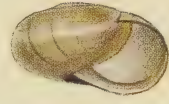
12. *H. pisana* s.-v. *alboranensis* W. & B.
Alboran Island, P. Dautzenberg.



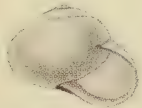
13. *H. pisana* s.-v. *rufescens* Benoit.
Palermo, Marquis Monterosato.



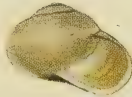
14. *H. pisana* s.-v. *cuttati* Bourg.
Sanary (Mus. Paris).



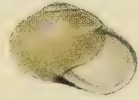
15. *H. pisana* s.-v. *pisanella* Serv.
Les Martigues (Mus. Paris).



16. *H. pisana* s.-v. *machadoi* Loc.
Faro (Mus. Paris).



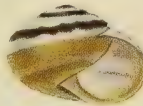
17. *H. pisana* s.-v. *pisanopsis* Serv.
Rochelle (Mus. Paris).



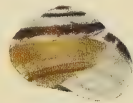
18. *H. pisana* var. *djerbanica* L. & B.
Var (Mus. Paris).



19. *H. pisana* s.-v. *rhdanica* Loc.
Oporto (Mus. Paris).



20. *H. pisana* s.-v. *donatii* Berth.
Faro, Portugal (Mus. Paris).



21. *H. pisana* s.-v. *carpiensis* L. & B.
Coimbra (Mus. Paris).

Var. concolor Moquin-Tandon.

Helix pisana var. *maritima* Des Moulins, Moll. Girond., 1827, p. 45.
Helix pisana var. *concolor* Moquin-Tandon, Hist. Moll., 1855, ii., p. 260.
Helix pisanopsis Servain, Etude Moll. Espagne, etc., 1880, pp. 112, 114.
Helix pisana var. *rufescens* Benoit, Test. Estram. Sicilia, 1859, p. 128.
Helix pisana var. *spirolineata* Monts., Moll. Sicilia, 1892, p. 15.

SHELL yellowish or dull yellow. (See Monogr., pl. xxx., f. 12).

The distinctly banded forms *spirolineata* and *rufescens* are included here, as their ground colour most nearly coincides with that of this variety.

The sub-var. *pisanopsis* is of an almost uniform pale ochreous tint, globose in form, with a well-rounded last whorl; it is nearest sub-var. *agaroï*, but differs in its colour, more globose shape, loftier and more conoid spire, less convex whorls, and larger and more rounded ultimate whorl. (See Monogr., pl. xxxi., f. 17).

The sub-var. *spirolineata* is described as overspread with black or sienna lines on an ochreous ground, "fondo dorato." (See Monogr., pl. xxxi., f. 10).

The sub-var. *rufescens* is described as tinged with rufous on a paler ground, spiral banding indistinct or absent. (See Monogr., pl. xxxi., f. 13).

The sub-var. *maritima* is yellowish with faint banding.

FOREIGN DISTRIBUTION.

France—Reported from the Gard by Clement; from Lunel, Béziers, and Lodève, Hérault, by Dubrueil; from Montpellier, Hérault, by Sarrazat; from Zamaris, Var, by Dautzenberg; and from Marseilles by J. R. le B. Tomlin. Sub-var. *pisanopsis* is recorded from Rochelle. Sub-var. *maritima*, abundant by the seashore, Biarritz, Basses Pyrénées, C. Mermet.

Spain—Corunna, Galicia! Prof. Hidalgo. Barcelona, Catalonia! G. K. Gude. Plentiful, and some almost orange in tint, found by Canon Horsley at Majorca; and by R. D. Darbishire at Gibraltar. Sub-var. *maritima*, Galicia, Dr. Macho.

Italy—Ancona, The Marches! G. K. Gude. Sub-var. *spirolineata*, Isle of Favignana (Monts, l.c.). Sub-var. *rufescens*, Madonie, Sicily (L. Benoit, op. cit.).

Portugal—Sub-var. *pisanopsis* from Lisbon, Cintra, Oporto, and Coimbra, Prof. Hidalgo.

Malta—Recorded by A. Issel.

Morocco—Mogador! G. K. Gude.

Algeria—Oran, and Koléah (Bourg., Mal. Alger., 1864, i., p. 237).

Africa East—Sub-var. *pisanopsis* is described by Letourneux and Bourguignat as inhabiting Somaliland between Cape Guardafui and the mouth of the Red Sea.

Var. ferruginea Moquin-Tandon.

Helix pisana var. *e* Menke, Syn. Moll., 1830, p. 32.
Helix pisana var. *ferruginea* Moquin-Tandon, Hist. Moll., 1855, vol. ii., p. 260.
Helix pisana var. *adusta* Monterosato, MS.

The var. *ferruginea* is described as of a ferruginous tint, with continuous and interrupted brown and reddish bands. (See Monogr., pl. xxx., f. 13).

The sub-var. *adusta* is described as small, solid, and somewhat depressed, of a reddish-fawn colour, with dark and confluent banding, lip whitish.

Diam. 16 mill.; alt. 11 mill. (See Monogr., pl. xxx., f. 14).

FOREIGN DISTRIBUTION.

Italy—Lido, Venetia! Ph. Dautzenberg.

Malta—A small, uniformly pale brownish form, Malta! G. K. Gude.

Morocco—Interior of Morocco, 1884! J. H. Ponsonly.

Algeria—Bône (Bourg., Mal. Alger., 1864, i., p. 236).

Tunis—Golita! G. K. Gude. Sub-var. *adusta*, Tunis! Marquis Monterosato.

Canary Islands—G. K. Gude.

Var. testudinea Monterosato, MS.

SHELL thin and subpellucid, of a greyish horny colour, greatly overspread with very dark marblings and maculations, simulating the appearance of tortoise-shell, lip tinged with pink.

CONTINENTAL DISTRIBUTION.

Italy—Chioggia near Venice! Marquis Monterosato.

VARIATIONS IN MARKINGS OF SHELL.

Var. *lineolata* Moquin-Tandon.

Helix alboranensis Webb and Berthelot, Pfr. Mon. Helic. Viv., 1848, p. 153.

Helix pisana vars. *lineolata*, *bifrons*, *interrupta*, *punctella* and *tæniola* Moq.-Tand., Hist. Moll. France, 1855, p. 260.

Helix pisana var. *sertum* Monts., Moll. terr. Sicilia, 1892, p. 15.

Helix pisana vars. *bilineata* and *musica* Monterosato, MS.

Helix pisana sub-var. *coalita* Taylor sub-var. nov.

The var. *lineolata* is described as a whitish shell, with numerous slender brown and rufous lines. (See Monogr., pl. xxx., f. 16).

This variety, with its several subsidiary modifications, is perhaps the most abundant of the numerous forms the species assumes.

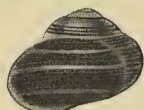


FIG. 439.

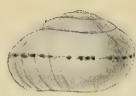


FIG. 440.

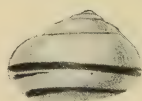


FIG. 441.

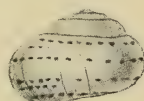


FIG. 442.

Subvariations of the *Helix pisana* var. *lineolata* Moq.

FIG. 439.—*Helix pisana* sub-var. *coalita* Taylor, Tenby, Pembrokeshire, Mr. A. G. Stubbs.

FIG. 440.—*Helix pisana* sub-var. *tæniola* Moq., Tenby, Pembrokeshire, Mr. A. G. Stubbs.

FIG. 441.—*Helix pisana* sub-var. *bifrons* Moq., Jaffa, Syria, Mr. F. H. Sikes.

FIG. 442.—*Helix pisana* sub-var. *punctella* Moq., Tenby, Pembrokeshire, Mr. A. G. Stubbs.

The sub-var. *musica* is described as having a whitish ground, with many fine and slender dark spiral bands arranged in groups with broader white spaces intervening, and resembling a sheet of music paper. (See Monogr., pl. xxx., f. 17).

The sub-var. *coalita* has a whitish ground with the spiral linear bands longitudinally fused in several groups or sections.

The sub-var. *tæniola* possesses one dark band above the periphery, resembling *H. virgata* in this respect. (See Monogr., vol. i., pl. ii., f. 10; and ff. 20 and 21, pl. xxxi., also shew this pattern of banding).

The sub-var. *bilineata* is whitish with two dark bands above the periphery, and sometimes others less conspicuous below. (See Monogr., pl. xxx., f. 18).

The sub-var. *bifrons* is described as uniformly white or whitish above, and banded below the periphery.

The sub var. *interrupta* is described as whitish with the spiral banding more or less broken up or interrupted.

The sub-var. *punctella* is described as whitish with brown or blackish spots above, and bands below periphery, but I restrict the application of this term to shells in which all the bands are broken up into more or less elongate spots. (See also Monogr., pl. xxx., f. 19).

The sub-var. *alboranensis* W. & B. was described by Pfeiffer in 1848 as small and subdepressed with a partially closed umbilicus, but in 1876 he redescribed the form as small and somewhat globose, with a minute but distinct umbilicus, and numerous bands, though sometimes unicolorous or marbled. In the specimen figured the interior is of a dark purplish hue. (See Monogr., pl. xxxi., f. 12). It is figured in the new edition of Martini und Chemnitz's Conchylien Cabinet, *Helix*, pl. 37.

This lack of precision in regard to the characters of this variety prevents the name superseding Moquin-Tandon's var. *lineolata* as the type of this section.

The sub-var. *sertum* is described as possessing numerous dark spiral lines, the one nearest the suture resembling a garland. (See Monogr., pl. xxxi., f. 11).

The var. *albida* of Lallemand (Mal. Alger., 1868, p. 37) described as whitish with faint flammules, may be a pale form of the sub-var. *punctella*.

The spiral banding which was formerly but erroneously believed to fade or even disappear with age is liable to so many subsidiary modifications that Dr. E. von Martens compiled a very complicated tabular exposition of those known at the time, which was published by Dr. Hartmann.

WALES.

Pembroke—Var. *lineolata* and sub-vars. *bifrons*, *coalita*, and *tæniola*, Tenby ! also sub-var. *bilineata*, South Cliff, Tenby ! A. G. Stubbs.

York N.E.—Dwarf specimens, labelled "Scarbro'," received from General Tripe in 1903 by Mr. J. C. Melvill.

FOREIGN DISTRIBUTION.

France—Sub-var. *bifrons*, Deauville, Calvados, and Roquefavour, Bonches-du-Rhône ! P. Dautzenberg ; by M. Dubrueil from Montpellier, Lodève, Béziers, and Lunel, Hérault ; and from the Gard by Clement. Sub-var. *interrupta*, recorded by Clement from the Gard. Sub-var. *musica*, Toulon, Var ! G. K. Gude. Sub-var. *punctella*, La Croisic, Loire Inférieure ! P. Dautzenberg ; and at Marseilles ! E. Atkinson. Sub-vars. *tæniola* and *bilineata*, Bastia, Corsica ! P. Dautzenberg.

Italy—Sub-var. *bilineata*, Bordighera, Liguria, and sub-var. *tæniola*, Terracina ! G. K. Gude. Sub-var. *punctella*, Lido, Venetia ! and sub-var. *tæniola*, Ventimiglia ! P. Dautzenberg ; and Rome ! Fred Booth. Sub-var. *bilineata*, near the sea, Viareggio ! sub-var. *sertum*, Isle of Favignana, Sicily ; and sub-var. *musica*, Monte Pellegrino, near Palermo ! Marquis Monterosato.

Malta—Sub-vars. *bifrons* and *interrupta*, recorded by Issel for Malta.

Spain—Var. *lineolata* and sub-vars. *bifrons*, *interrupta*, and *punctella*, Galicia, Dr. Macho. Sub-var. *lineolata*, Catalonia ! sub-var. *musica*, Mahon, Minorca, and sub-var. *bilineata*, Palma, Majorca, P. Dautzenberg. Sub-var. *bifrons*, Ferrol, Galicia ! Prof. Hidalgo ; and Murcia ! G. K. Gude. Sub-var. *punctella*, Jaen, Andalusia ! P. Dautzenberg. Sub-var. *tæniola*, Gibraltar ! R. D. Darbishire ; and Alicante, Prof. Hidalgo. The sub-var. *alboranensis* is cited from Cadiz by Dr. C. A. Westerlund, and M. Dautzenberg has specimens from the Isle of Alboran.

Portugal—Sub-var. *alboranensis* is recorded from Lisbon by Dr. Westerlund.

Canary Isles—Var. *lineolata* ! G. K. Gude ; Teneriffe, Prof. J. H. Salter ; sub-var. *musica*, Las Palmas, Grand Canary ! W. J. Farrer. Sub-var. *coalita*, Porto Santo ! F. Booth.

Morocco—Sub-var. *bifrons*, Mazagan ! sub-var. *tæniola*, Mogador and Tangiers ! and sub-var. *musica*, Casa Blanca and Mogador ! G. K. Gude.

Algeria—Sub-var. *bifrons*, Hussein Dey near Algiers ! A. Shaw. Sub-var. *punctella*, Hussein Dey near Algiers ! P. Dautzenberg. Sub-var. *tæniola*, Bône, J. R. Bourguignat. Sub-var. *albida* Lallemant, Algiers (Lallemant, op. cit.).

Tunis—Sub-vars. *bifrons* and *musica*, Golita ! G. K. Gude.

Egypt—Sub-vars. *bifrons* and *tæniola*, Alexandria ! G. K. Gude. Sub-var. *musica*, Alexandria, Rev. Canon Horsley ; and Suez ! P. Dautzenberg.

Syria—Sub-var. *bifrons*, Jaffa, 1904 ! F. H. Sikes.

Cape Colony—Var. *lineolata* is one of the most abundant forms on Robben Island, according to Mr. Swanton, and is the commonest variety in the colony generally, according to the Rev. Canon Horsley.

Var. undulata Taylor, var. nov. (See also Monogr., pl. xxx., f. 20).

SHELL with spiral banding interrupted, but fused transversely.

Pembroke—Tenby ! A. G. Stubbs.

FOREIGN DISTRIBUTION.

Italy—Lido, Venetia ! P. Dautzenberg.

Tunis—Specimens collected in 1846 on the banks of R. Ghabs, Golita, are now in the collection at the British Museum.

Morocco—Specimens from Mogador in Mr. J. Cosmo Melvill's collection, received from Herr Rolle, are referable to this variety.



FIG. 443.—*Helix pisana* var. *undulata* Taylor.
Tenby, Mr. A. G. Stubbs.

Var. diaphana Bourguignat.

Helix pisana var. *diaphana* Bourguignat, Mal. Alger., 1864, p. 237.

Helix pisana var. *fasciata-translucens* Gassies, Mal. Aquit., 1867, p. 123.

Helix (Euparypha) pisana var. *alba* Pallary, Journ. de Conch., 1904, p. 11.

Helix pisana var. *dilucida* Monterosato, ms.

SHELL pure white, with transparent banding. (See Monogr., pl. xxx., f. 10).

The var. *diaphana* s.s. is described as "glistening white, thin and diaphanous, with sub-opaque bands"; and furnishes yet another instance of the confusion by able scientists of the transparent banding of the shell with the more opaque ground tint.

The sub-var. *fasciata-translucens* is pure white with transparent banding.

The sub-var. *dilucida* is described as white with subpellucid bands and white lip.

The sub-var. *alba* Pallary is described as porcellaneous-white, with greyish markings, an expression probably indicating their translucency.

ENGLAND AND WALES.

Channel Isles—Grève d'Azette, Jersey, 1905 ! F. H. Sikes.

Pembroke—Rare, South Cliff, Jubilee Gardens, and railway bank, below the Wreck field, Tenby, 1895 ! A. G. Stubbs.

IRELAND.

Dublin—Common on sandhills, Rush near Dublin, Sept. 1885 ! J. R. Redding.

FOREIGN DISTRIBUTION.

France—La Pouliguen, Loire Inférieure ; and Trégastel, Côtes du Nord ! Ph. Dautzenberg. Sub-var. *fasciata-translucens* cited by Gassies for Arcachon, Gironde.

Italy—Sub-var. *dilucida*, Ascoli-Piceno, The Marches ! Marquis Monterosato.

Spain—Reported from Gibraltar, R. D. Darbishire.

Morocco—Sub-var. *alba* Pall., Tangiers, Tetuan, and Chéchaouen (Pallary, l.c.).

Algeria—Recorded by M. Bourguignat from Oran Arzew, Boghar, Algiers, Bône, and Constantine.

Var. **pieta** Taylor, var. nov. (Monogr., pl. xxx., f. 4).

SHELL whitish, beautifully variegated with sienna and dark brown.

Possibly this may be the *Helix maculata* of Müller and Menke, which Moquin-Tandon simply described as "more depressed and more or less keeled," but which Müller states is marked by small fuscous spottings.

WALES.

Pembroke—On wild sage and brambles, at foot of Jubilee Gardens, near the Burrows, Tenby ! A. G. Stubbs.

Var. **semifulva** Taylor, var. nov. (Monogr., pl. xxx., f. 6).

SHELL with the upper half of the whorls of an uniform pale fulvous tint, darker towards the aperture ; lower half of whorls white with fulvous and brown banding.

This interesting variety in all the subvarietal differences of colour shows in a striking manner the probable sequence in the evolution of the shell colouration, the whitish ground colour being overspread in parts by the fulvous tint upon which is superposed the darker tertiary lineolation, bringing to mind the almost parallel association of tints in certain variations of *Helix nemoralis* and other species.

FOREIGN DISTRIBUTION.

Morocco—Mogador, collected by Lt.-Col. Parry ! G. K. Gude. Almost identical specimens have been found by Mr. J. H. Ponsonby "in the interior of Morocco," and are now in the collection of M. Dautzenberg ; curiously enough some specimens of *Helix ustulata* in the collection of Mr. Melvill, found by Mr. T. V. Wollaston on Lanzarote, one of the Canary Islands, show the same peculiar colouration.

Canary Islands—Specimens of this variety exist in the "Darbishire collection" in the Manchester Museum ; one or more striking examples being fulvous above, and entirely white and unbanded below the periphery.

Var. **menkeana** Moquin-Tandon.

Helix pisana var. *menkeana* Moquin-Tandon, Hist. Moll. Fr., 1855, ii., p. 259.

Helix pisana var. *luteo-zonata* Bourguignat, Mal. Alger., 1864, i., p. 236.

Helix pisana var. *subzonata* Bourguignat, op. cit., pl. 26, ff. 4-5.

Helix pisana var. *aurea* Monterosato, ms.

The var. **menkeana** is described as whitish, with broad reddish bands.

The sub-var. **luteo-zonata** has broad ochreous bands and fawn-coloured lineoles.

The sub-var. **aurea** is whitish with orange banding (see Monogr., pl. xxxi., f. 2).

The sub-var. **subzonata** is whitish with faint banding (see Monogr., pl. xxxi., f. 1).

WALES.

Pembroke—Tenby, Aug. 1882 ! W. H. Boland. Sub-var. *subzonata*, Wreck field, Tenby ! A. G. Stubbs.

IRELAND.

Louth—Sub-var. *luteo-zonata*, Clogher ! P. H. Grierson.

FOREIGN DISTRIBUTION.

France—Sub-vars. *luteo-zonata* and *subzonata*, S. Raphaël, Var ! and Perpignan, Pyrénées Orientales ! G. K. Gude ; Roquefavour, Bouches-du-Rhône ! and Bastia, Corsica ! P. Dautzenberg.

Italy—Sub-var. *subzonata*, Bordighera and Ventimiglia, Liguria ! Corneto near Rome ! and Girgenti, Sicily ! G. K. Gude ; Acireale, Sicily ! C. Platania-Platania. Sub-var. *aurea*, Girgenti, Sicily ! Marquis Monterosato.

Spain—On Spanish territory close to Gibraltar, Sept. 1884 ! Capt. E. F. Beecher. Tarragona, Catalonia ! Dr. C. W. Viner. Sub-var. *aurea*, Andalusia. F. de Nerville ! P. Dautzenberg. Sub-var. *subzonata*, Alicante and Albufera, Valentia, and San Sebastian, Basque provinces ! Prof. Hidalgo ; Palma, Majorca ! G. K. Gude. Sub-var. *luteozonata*, Valencia, Prof. Hidalgo.

Algeria—Sub-var. *luteo-zonata*, Oran, Algiers, Constantine, Bône, etc., and sub-var. *subzonata*, Oran, Mostaghanem (Bourguignat, l.c.).

Morocco—Very characteristic specimens collected in 1883 in Morocco ! by Mr. J. Cordukes. Sub-var. *subzonata*, Mogador and Casa Blanca ! G. K. Gude.

Azores—Sub-var. *subzonata*, Fayal ! G. K. Gude.

Var. *sagittifera* Taylor, var. nov.

SHELL whitish, and bearing spiral series of arrow-head like markings.

WALES.

Pembroke—Not uncommon about Tenby, with arrow head and feather-like markings, A. G. Stubbs.

FOREIGN DISTRIBUTION.

Algeria—Oran (Bourguignat, Mal. Alger., 1864, vol. i., pl. 26, ff. 6, 7).

Madeira—Porto Santo ! W. A. Gain.

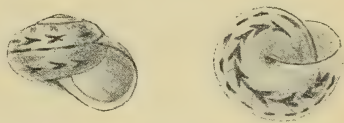


FIG. 444.—*Helix pisana* var. *sagittifera*. Oran, Algeria (after Bourguignat).

MONSTROSITIES.

Monstr. *sinistrorsum* Taylor, monstr. nov.

SHELL reversed or sinistral in coiling.

Dr. Hartmann has remarked that sinistral shells are almost universally more depressed than dextral ones.

FOREIGN DISTRIBUTION.

France—Recorded from Toulon, Var. by Mr. R. Cairns and Mr. J. R. le B. Tomlin ; from Montpellier, Hérault, by M. Moitessier, in which department it is said by M. Dubrueil to be "somewhat common." A specimen is in the Rev. Dr. Norman's collection labelled "Southern France"; and Mr. J. Cosmo Melvill has a specimen from Southern Europe.

Morocco—M. Pallary records finding a sinistral specimen at Chéchaouen.

Algeria—Constantine (Bourg., Mal. Alger., 1864, i., pl. xxvi., f. 10).

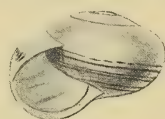


FIG. 445.—*Helix pisana* m. *sinistrorsum* Taylor. S. Europe, Mr. J. C. Melvill.

Monstr. *scalare* Mabilie.

Helix pisana monstr. *scalaris* Mabilie, Taslé, Moll. Morbihan, 1867, p. 58.

Helix pisana monstr. *scalariforme* Milnes, Journ. of Conch., 1889, vi., p. 146.

Helix pisana monstr. *disjuncta* Letourn. et Bourg., Prodr. Tunis., 1887, p. 81.

SHELL with whorls more or less disunited.

In the *subscalarid* forms the dislocation of the whorls is less pronounced.



FIG. 446.



FIG. 447.



FIG. 448.

Scalarid Forms of *Helix pisana* Müller.

FIG. 446.—*Helix pisana* monstr. *scalaris*, Southern Europe, Mr. J. C. Melvill.

FIG. 447.—*Helix pisana* monstr. *scalaris*, Tenby, South Wales, Mr. A. G. Stubbs.

FIG. 448.—*Helix pisana* monstr. *scalaris*, Palermo, Sicily, Marquis Monterosato.

This form was believed by the late Dr. Gassies to arise from hybridization with a turreted mollusk, as it is somewhat frequently found in certain localities around Montpellier, where *Rumina decollata* occurs ; this opinion was greatly strengthened by his success in inducing *H. pisana* to pair with *Rumina decollata* in captivity, the resulting progeny yielding a large percentage of pyramidal and scalariform shells.

WALES.

Pembroke—Giltar Point, Tenby, 1888 (Rev. H. Milnes, op. cit.). Scalarid and subscalarid specimens at Tenby ! A. G. Stubbs.

CONTINENTAL DISTRIBUTION.

France—Recorded from Montpellier, Hérault, by Moitessier ; from Toulouse, Haute Garonne, by Reyniès ; and from Corsica by Payraudeau. Taslé records it from Belle-île, Port Donan, Morbihan, on the authority of Mabille. Subscalarid specimen, Toulon ! P. Dautzenberg.

Italy—Monstr. *scalare* found at Palermo, Sicily ; and sub-var. *subscalaris* at Girgenti by Marquis Monterosato.

Geographical Distribution.—*Helix pisana* in its distribution displays a great similarity to *Helix aspersa*, but being a somewhat degenerate and regressive species, its European range is more restricted to the southern and western regions, and more confined to the coast, but in suitable districts of the less dominant countries by no means absolutely so, as in Spain it extends to the most inland districts, and in the south and west of France still persists in localities many leagues from the coast-line, though always becoming less common as it recedes from the littoral region.

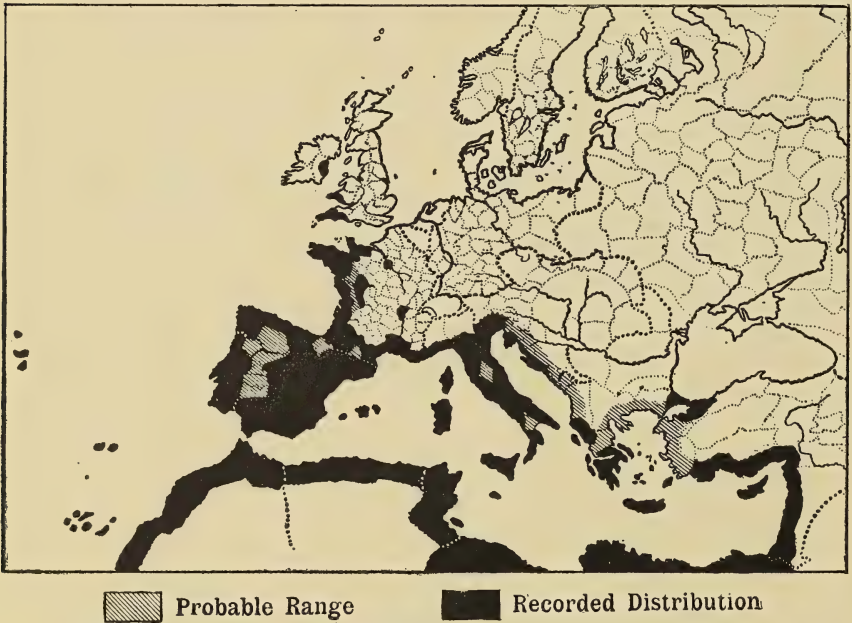


FIG. 449.—Geographical Distribution of *Helix pisana* Müller.

In Europe it abounds on all the coasts and probably every island of the Mediterranean sea. On the Atlantic seaboard, it is abundant in France, Spain, and Portugal, reaching its present furthest northern continental extension at Deauville in the department of Calvados, from whence it is reported by M. Dautzenberg, and though probably formerly inhabiting the extreme North-east of France, as evidenced by the finding of its fossil remains by Dr. Bouly de Lesdain in the Pleistocene dunes of Ghyvelde near Dunkirk, associated with those of *Helix lactea*, *Leucochroa candidissima*, *Rumina decollata*, and other species formerly existent there, but now, also completely expelled from that region.

Distribution of *Helix pisana* Müller

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilts N.	48 Merioneth
8 Wilts S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid
21 Middlesex	HUMBER
22 Berks.	61 S. E. York
23 Oxford	62 N. E. York
24 Bucks.	63 S. W. York
ANGLIA	64 Mid W. York
25 Suffolk E.	65 N. W. York
26 Suffolk W.	TYNE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Hunts.	69 Westmorland
32 Northampton	and L. Lanes
SEVERN	70 Cumberland
33 Gloucester E.	71 Isle of Man
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easternness
76 Renfrew	W. HIGHLANDS
77 Lanark	97 Westernness
E. LOWLANDS	98 Main Argyle
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Pth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

In the various islands of the North Atlantic ocean—Madeiran, Canarian, and Azorean archipelagos—this species abounds and presents at certain points a more primitive facies.

In North Africa, the species extends along the whole seaboard and far into the interior of Algeria and Morocco. It also abounds on the littoral of Algeria, Tunis, Tripoli, Egypt, and Somaliland, and has been introduced and now occurs in vast profusion at various points in South Africa.

In Asia, it abounds along the coast of Asia Minor, the sea of Marmora, the south-western shores of the Black Sea, and probably inhabits all the islands of the Ægean Sea and those adjacent to the mainland. It is also plentiful along the littoral of Palestine; and is reported by Mr. J. Bliss from the Caucasus at Tiflis and from the road-side near Ananaur at an altitude of 2,335 feet, two localities far removed from any known or recorded habitat.

It is recorded by Baron Férussac and others as found in the United States, but it is unknown there, Mr. W. G. Binney regarding the records as probably erroneous, and based upon specimens of *Hemitrochus varians*.

In the British Isles, its range though quite in harmony with its general distribution, is somewhat discontinuous, being as far as is known restricted to the Channel Islands, the south-western districts of England and Wales, and the east coast of Ireland; and though regarded by the late Dr. Mörch as introduced by the Romans to these islands, that belief is now shown to be unfounded by the discovery of its remains by Mr. J. Sinel in undisturbed earth beneath Neolithic relics in the Channel Islands.

ENGLAND AND WALES.

Channel Isles—*Helix pisana* is found in Jersey and Guernsey, and probably exists in some other islets of the group. In Jersey, according to present knowledge, it is restricted to the south of the island, along the shores of St. Clement's and St. Aubyn's Bays, and to Green Island, all in the immediate vicinity of St. Helier's.

In Guernsey, it is found at Vale Castle, and fine and well coloured specimens are plentiful under the shade of the sea-wall at Vazon Bay; at Bordeaux Harbour the shells are larger, thinner, and more translucent, with a good proportion of the var. *albida*, which is not found at Vazon.

Dr. Lukis is credited with the introduction of *H. pisana* into Guernsey, having, according to his daughter, Mrs. Collings, brought over from Jersey in 1860 many living specimens, which he distributed at Vazon Bay and at Vale Castle.

In Sark, Mrs. Collings records that her father in 1860 also sent her about a dozen and a half Jersey shells for naturalization there, and that she placed them on the right bank going down towards the Port du Moulin, but although for a few years afterwards a shell or fragments of shell were occasionally observed, it is probable they have now entirely died out.

Cornwall W.—Formerly and probably still in profusion at St. Ives, on the slopes of the hill descending into the town and chiefly about the promontory to the north. It is also recorded from Falmouth by Mr. W. P. Cocks, and specimens thus labelled are in the British Museum; by Dr. Leach from Whitesand Bay, and it has been found at Crantock near Newquay by Rev. A. H. Melvill.

Devon N.—On the sandhills of Woolacombe and at Braunton Burrows (Besley's North Devon, 1867, p. 125).

Somerset N.—Enumerated by Dr. C. W. Viner among the species found by himself near Bath.

Dorset—Recorded by Dr. Pulteney as found on sandbanks between Lulworth and Weymouth, and recently discovered by the Rev. C. O. Pickard-Cambridge on Muston Down, Winterborne!

Sussex—Three specimens of *Helix pisana* formerly in the collection of the well-known botanist, the late Frederick Townsend, and now in the Haslemere Museum, were labelled "*H. pisana*, Sussex, Mr. W. Hawker, 1850."

Essex N.—Recorded from Felstead by Mr. J. French, in error for *H. virgata* (Essex Nat., Apr. 1888, p. 46).

Oxford—Mr. W. E. Collinge recorded (Sc. Goss., 1890, p. 92) the finding of a specimen on the railway embankment at Charlbury.

Derby—Mr. E. Collier introduced a quantity of this species into an apparently suitable position at Monsal Dale, but the experiment was not successful.

Glamorgan—Dr. Gwyn Jeffreys in 1862 recorded two attempts, at an interval of three years, to acclimatize this species on Swansea Burrows, and though at first the immigrants appeared to thrive, they afterwards seemed to disappear; but in the autumn of 1874 Mr. R. Rimmer found that far from being extinct on the Burrows, they had increased immensely in numbers, and even in 1883 they were found by Mr. E. Collier to be quite common, especially near the starting-place of the old tram-line to Oystermouth; but a few years later—in 1887—the Rev. Canon Horsley reports the species as decadent and far from common, while Mr. H. Rowland Wakefield now entirely omits it from his list of Swansea shells, as he has regularly and persistently searched the district for some years past, in conjunction with the local Field Club, without finding a trace of a single shell, though recently he has picked up a few dead specimens at Singleton.

Pembroke—In marvellous abundance on the grassy slopes about Tenby, and ranging along the coast from Saundersfoot on the north, to Manorbier on the south, and extending inland in places about a mile.

Colonel Montagu in 1803 first discovered the species here, and described it as occurring “on the rocks that verge the town of Tenby, on the south, close to the sea; and on the sands to the west of that place, contiguous to the shore”; and numerous later observers have confirmed the accuracy of the record.

Mr. A. G. Stubbs, who has especially studied the distribution of the species about Tenby, has described it as very abundant about the town of Tenby, especially on hillocks near the sea and around Black Rock, also plentiful on the south-west slope of Castle Hill; along the South Cliff, especially beneath the Esplanade; in Jubilee Gardens; on the burrows and railway banks and on the south-west side of St. Catherine's Rock; at the opposite side of the rock the shells are much rarer but higher spired and of larger size yet never with rosy lips.

To the south it abounds all along the burrows to Giltar Point, it is found at Penally, and is plentiful on Caldy Island, and along the cliffs from Giltar nearly to Lydstep, and also at Manorbier still further to the west.

To the north it is occasionally found at Saundersfoot, but was found plentifully there in 1883, on a piece of sandy ground not far from the sea, by Mr. C. Jefferys.

York N.E.—Specimens sent to Mr. J. Cosmo Melvill by General Tripe are labelled “Scarbro.”

Northumberland and Durham—As *Helix cingenda* it is recorded by Mr. Alder as found by Mr. W. Robertson on the sea banks of Northumberland and Durham, but without precise locality, but said to be certainly either at Seaton Sluice, Bam-borough, or Hawthorn Dene.

SCOTLAND.

Sutherland E.—Mr. W. Baillie in 1886 established a colony at Brora, which survived the winter, and some were still to be found in the spring of 1889, and may possibly still exist there.

IRELAND.

Louth—Mr. W. Thompson in 1840 recorded the finding of this species by Mr. Joseph Humphreys on the north side of the River Boyne about three miles east of Drogheda; Dr. Kinahan in 1854 recorded it from Baltray, and its occurrence there was confirmed in May 1904 by Mr. P. H. Grierson, who in September of the same year also discovered the species to exist at Termonfecken and Clogher, the latter the most northerly habitat yet known for the species; while Dr. Scharff has recorded the finding of this species by Miss Sidney Smith at a place a few miles north of the River Boyne.

Meath—This species was first noticed as Irish in 1818, in Pennant's British Zoology, vol. iv., p. 369, the specimens being collected by Mr. J. O'Kelly on the north side of the Delvin, the stream which separates Dublin from Meath. Dr. Farran in 1854 recorded its occurrence about Laytown, Bettystown, and up to Drogheda. Dr. Scharff discovered it to exist at Julianstown, June 1894! and Mr. P. H. Grierson found it at Mornington, Oct. 1904! and also confirmed Dr. Farran's record of its existence at Laytown!

Dublin—Mr. A. R. Hogan in 1854 described the species as well-marked and plentiful on the sea coast at Rush, where it is still abundant. Dr. Farran about the same time discovered it at Knockangin, about $1\frac{1}{2}$ miles north of Balbriggan, and also placed on record his apparently unsuccessful attempts to acclimatize the species at Portmarnock, and at Feltrim near Malahide.

There are specimens in the National Museum, Dublin, labelled "Drumcondra," but Mr. Stelfox informs me that the species does not seem to live there, and these specimens may have been taken with the sand which is frequently carted for building purposes from the localities where *H. pisana* naturally exists.

Kildare—Mr. L. E. Adams (Manual, p. 82) quotes Kildare as one of the counties for this species, but further information has been unobtainable.

Wexford—Dr. Farran recorded in 1854 that Mr. Butler Bryan distributed a number of living Dublin specimens on the demesne at Ferns, but though the experiment apparently failed, he purposed again attempting to naturalise the species there but on a more extensive scale.

Queen's Co.—Specimens are in the "Warren Collection" of the National Museum, Dublin, labelled "La Bergerie, Rev. B. J. Clarke," but Mr. Clarke's note books, which are preserved at the Museum, contain no mention of the occurrence of this species at La Bergerie, and only refer to the known localities on the Dublin coast.

Galway W.—Dr. Farran in 1854 stated that the late Mr. McAlla had informed him that he had seen the shell at Bunowen, in Connemara, West Galway, but there has been no confirmation of the record, although the district has been often carefully examined, but Mr. Stelfox informs me that a large form of *H. virgata* is found there, which might easily on casual inspection be mistaken for *H. pisana*.

Kerry—Mr. Andrews reported in 1854 that on the promontory of Iveragh he had found a number of *H. cingenda*, firmly attached by a kind of deposit or incrustation to the leaves of the yellow water Iris, in company with *Succinea putris*; but this assumed discovery has also never been confirmed.

GERMANY.

A specimen exists in the collection of Mr. G. K. Gude, labelled "Heidelberg," but the locality is certainly erroneous as indicating a natural habitat of the species.

BELGIUM.

MM. Colbeau and Lanszweert in 1868 attempted to naturalize the species at Ostend by distributing over the dunes a number of specimens from Algiers.

FRANCE.

Almost restricted in its distribution to the maritime departments, but extends many leagues inland from the coast, although its occurrence in the Vosges, chronicled by M. Puton, is erroneous. It is recorded from Alpes Maritimes, Aude Basses Pyrénées, Bouches du Rhône, Calvados, Charente Inférieure, Côtes du Nord, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Pyrénées, Hérault, Ile-et-Vilaine, Indre-et-Loire, Landes, Loire Inférieure, Manche, Morbihan, Pyrénées Orientales, Rhône, Var, Vaucluse, Vendée, Vienne, and the Island of Corsica.

In addition, it was recorded in 1882 from Lyons by M. Locard, who was of opinion that the species had migrated with certain plants from the Mediterranean coast.

M. Mabille has also described its introduction in 1870 to the banks of the River Marne at Charenton near Paris, as being due to a friend who, on his return home from travelling in the south of France, brought with him a large basketful of these snails for table use, but falling ill, the nurse, who attributed his malady to the snails, emptied the basket containing them upon the river bank, by the omnibus dépôt, where the environment being favourable, they prospered, but, according to Dr. Germain, have gradually become modified, as though at first all were fine, strong and distinctly banded shells, the great majority are now, though still of good size, of a delicate texture and a pure subtransparent white. The area inhabited at first extended between the steanboat landing at the Bridge of Charenton and the mill at Alfort to a distance of 600 or 700 yards down the river, but owing to the crowds of Sunday excursionists who now regularly frequent and promenade the banks of the river, trampling upon the vegetation, and otherwise rendering the locality unsuitable for these mollusks, the colony has been compelled to gradually migrate further and further down the river banks, and are now living under less favourable conditions and therefore, much less common than formerly.

M. Dautzenberg also possesses specimens from the Seine-et-Oise, labelled 'Rueil, near Paris, 1902,' which were procured from a colony artificially established there some time before.

It is, however, in the highest degree probable that these artificially established colonies, if placed amidst a somewhat more highly developed fauna, or in districts where the species had probably formerly existed, and from whence they have been expelled by natural causes will not be permanent, but will eventually become extinct.

ITALY.

Most abundant near the coast, but also found some distance inland, and is known to exist in Abruzzi, Apulia, Calabria, Campania, Emilia, Liguria, Marches, Rome, Tuscany, Venetia, the Islands of Sardinia, Sicily, Elba, Gozo, Malta, Favignana, Pelagosa, Ustica, Lampedusa, etc., and is probably abundant in Basilicata, but is not yet recorded from Lombardy, Piedmont, or Umbria.

AUSTRO-HUNGARY.

Recorded from the maritime districts of Dalmatia, Goritz, Illyria, and Istria. Specimens, said to have been collected many years ago near Vienna, are in the collection of Mr. J. Ray Hardy and others, and were at one time on public view in the Manchester Museum; but it is probable that the locality is erroneous, as the species is quite unknown in Austria.

BALKAN PENINSULA.

Greece—Though probably found on all the Islands of the Ægean and Ionian Seas, and along the maritime zone of the mainland, yet records are only available for the Morea, the Islands of Santorin, Syra, Phanar, Zante, and the Archipelago.

Turkey—Probably common throughout in the littoral region of the Marmorean and Mediterranean seas and the neighbouring islands, but as yet is only known from Constantinople and Crete.

SWITZERLAND.

Erroneously enumerated for Geneva in 1824 as *H. rhodostoma* by Jurine.

SPAIN AND PORTUGAL.

Spain—Distributed throughout the peninsula in moist situations, and though most abundant in the littoral zone and less common in the central provinces, is not restricted to the coast as in some other countries. The species occurs in Andalusia, Aragon, Asturias, Basque Provinces, Catalonia, Old and New Castile, Galicia, Murcia, Valencia, the Balearic Isles, and the Islet of Alboran, but precise records are not yet available for Estremadura, Leon, or Navarre.

Portugal—Probably inhabits every province, but as usual, becomes more plentiful on the coast, and records are known from Alemtejo, Algarve, Beira, Estremadura, Minho, as well as from the Berlingas, and other islets adjacent to the coast, but it has not yet been recorded from Tras-os-Montes.

ATLANTIC ISLES.

Madeira—Very common at Caniçal and on the arid hills to the east of Cape Garajao. It lives also on the sandy plains of Porto Santo, and on the Salvages.

Canary Islands—Abundant on the lower ground on Grand Canary; but also found prospering at an altitude of 1,150 feet in the gardens of Ste. Brigida Hotel, Monte; its place on the higher grounds and the Isleta is, according to Capt. Farrer, filled by the var. *grasseti*. It is also found on the Islands of Teneriffe, Lanzarote, Fuerteventura, Gomera, Palma, Graciosa, and probably every islet of the group.

Azores—Recorded from Fayal, and probably inhabits the rest of the islets.

NORTH AFRICA.

Algeria—The commonest species of the maritime zone, and penetrates deeply into the arid deserts of Sahara, being found at El-Aghouat, Tuggart, Metlili, etc., but has not been found in Upper Kabylia. It has been recorded from Algiers, Bône, Constantine, Hussein Dey, Mostaghanem, Oran, Tlemcen, Philippeville, etc.

Morocco—Very common along the coast, and extending far into the interior; it is known to exist at Tangiers, Tetuan, Cape Blanco, Mogador, Mazagan, etc.

Tunis—Excessively common and variable, but less numerous in the mountainous districts; it is recorded from Tunis, Golita, Khroumirie, the Isle of Djerba, etc.

Tripoli—Abundant especially in the littoral region; Dr. E. von Barry found it swarming around the city of Tripoli, and it is recorded by Dr. Kobelt from Benghazi.

Egypt—Found throughout Lower Egypt, and especially noted from Alexandria and Suez, and also found by Dr. and Mrs. Longstaff at Helwan near Cairo.

ASIA MINOR.

Asia Minor—Distributed along the shores of the Mediterranean, the Sea of Marmora, and the south-western region of the Black Sea, and has been reported from Kadikoi, Scutari, Smyrna, Alexandretta, Cilicia, Adalia, Pamphylia, and Lycia, also from Jaffa, Beyrout, Gaza, and elsewhere in Palestine, as well as Rhodes, Cyprus, Mytilene, Lemnos, Schio, Cos and other islands off the coast; and Mr. Bliss assures me that in March 1899 he found it living in the botanical gardens. Tiflis, and collected dead shells on the road-side near Ananaur, between Vladikavkas and Tiflis, at an elevation of 2,335 feet.

ETHIOPIAN REGION.

Somaliland—Abounds on the coast-line from Cape Guardafui to the mouth of the Red Sea, from whence the vars. *çomaliana* and *tohenica* were obtained.

Cape Colony—Reported from Port Elizabeth and Cape Town by Messrs. Melvill and Ponsonby. It abounds near the sea margin at Sea Point, a suburb of Cape Town, and according to Mr. Swanton, swarms on Robben Island, where it is rapidly destroying all the herbage. It was found swarming close to the beach at Green Point in 1905 by Mr. W. Denison Roebuck; and according to Mr. A. Mayfield also occurs at Hout's Bay.

Natal—Found by Dr. Longstaff at Durban.



FIG. 450.—*Helix pisana* Müller clustering upon its food plants on the burrows at Tenby (from photo. by Mr. Charles Jefferys).

GENUS *HELICIGONA* Férussac.

HISTORY.—This genus, better known as *Campylæa*, was instituted by Baron Férussac in 1819, and embraces the groups *Chilotrema* and *Arianta* of Leach, propounded in 1831; *Chilostoma*, *Isognomostoma*, and *Latomus* of Fitzinger in 1833; *Cingulifera*, *Corneola*, and *Lenticula* of Held published in 1837; *Campylæa* of Beck established in the same year; *Sterna* of Albers in 1850; *Elona* of Adams in 1855, and is included by Dr. C. A. Westerlund in his section *Paurotænia*, characterized by the possession of not more than four bands, and the frequent presence of a paler peripheral zone.

Pilsbry also includes *Fruticocampylæa* and *Tacheocampylæa*, and in fossil forms *Tropidomphalus*, *Metacampylæa*, *Mesodontopsis*, and *Galactochilus*.

The *Helicigonæ* are really an offshoot or branch from the *stemma* of the true *Helices*, still retaining or reverting to several primitive features in shell and animal, as the more usual presence of the somewhat highly placed pale peripheral zone, while the simple vermiform mucus glands recall their distant Euadeniate ancestry.

Generic Characteristics.—The ANIMAL is said to externally resemble the true *Helices*, but it may be noted that in the British representatives of the genus the lateral or genital grooves are quite absent on the left side of the body and only faintly indicated or deficient on the right side.

The SHELL is described as turbinately or depressly globose, varying to a lenticular shape, usually umbilicated, and of moderate or large size, with a smooth, costulate, granulate, or hairy surface, usually of a brown or an unicolorous horny colour, or may be mottled and streaked, or possess a single suprapерipheral band, although sometimes more bands may be present. APERTURE obliquely lunate or oval; LIP expanded, but reflected below, and dilated at its junction with the columella.

The true characters of the genus were first indicated by Schmidt to be the two-bladed DART, the stout diverticulum of the SPERMATHECA DUCT, closely bound to the UTERUS by a wide vascular membrane, and the simple and vermiform paired MUCUS GLANDS; and the shell, though frequently bandless, is never truly five-banded as in *Helix*.

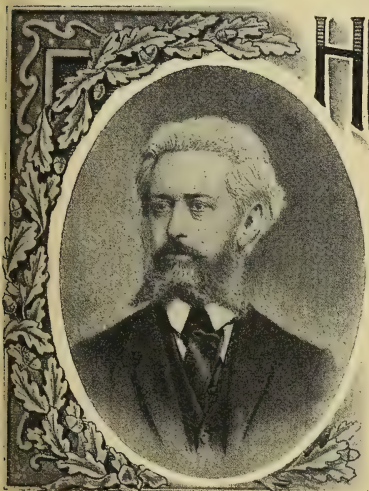
The character of the DART alone, though so characteristic, is not decisive, for other genera possess darts, approaching the two-bladed DART of this group, but the highly-developed diverticulum is a constant feature.

The REPRODUCTIVE ORGANS show an elongate OVOTESTIS, a short PENIS continued into an EPIPHALLUS, upon which the RETRACTOR is inserted, and ending in a long FLAGELLUM spirally twisted at the proximal end, which imparts a characteristic form to the spermatophore by means of which the seminal element is transferred during pairing; the DART SAC is simple and somewhat elongate, placed rather high on the vagina, and contains a curved dart with a slightly expanded base and a flattened lanceolate head; the SPERMATHECA is small and globose on a long and slender stem, and bears a stout diverticulum, which is usually longer than the spermatheca duct, and bound closely to the uterus by a broad and richly vascular membrane, this being a constant generic character.

The genus ranges from Southern Europe as far north as Sweden and England, but it is more especially an Alpine and South European group, being less abundant or almost absent in Central Europe, although certain members attain the extreme north of Europe.

***Helicigona lapicida* (Linné).**

- 1674 *Cochlea altera, pulla, sylvatica, spiris in aciem depressis*, Lister, Phil. Trans., vol. ix., p. 99, pl. vi., f. 13.
 1692 *Cochlea nostras, umbilicata, pulla*, Lister, Hist. Conch., tab. 69, f. 68.
 1695 *Cochlea terrestris, media acie acuta*, Petiver, Gazoph., tab. 92, f. 11, no. 734.
 1742 *Cochlea terrestris depressa & umbilicata, ore ovali, umbilico majore, in quo anfractus spirarum in extrema superficie acuminatarum observantur, mucrone tantillum elevato*, Gualtieri, Index Test. Conch., tab. 3, f. N.
 1746 *Cochlea testa utrinque convexa, subtus perforata, spira acuta, apertura ovata transversali*, Linn., Faun. Suec., i., p. 371, no. 1298.
-
- 1758 *Helix lapicida* Linné, Syst. Nat., ed. x., p. 768.
 1778 — *acuta* Da Costa, Brit. Conch., p. 55, t. 4, f. 9.
 1789 — *affinis* Gmelin, Syst. Nat., ed. xiii., p. 3622, no. 161.
 1855 — *lapicidites* Grateloup & Raulin, Catal. Moll., p. 13.
 1858 — *lapidicola* Bellars, Catal. Brit. Shells, p. 12, pl. i., f. 26.
 1815 *Vortex lapicida* Oken, Lehrb. Nat., iii., p. 314.
 1822 *Helicigona lapicida* Férussac, Prodr., t. 66*, f. 6, no. 150.
 1822 *Carocolla lapicida* Lam., Anim. Sans. Vert., vi., p. 99, no. 16.
 1826 *Helicella mammillata* Risso, Moll. Alp. Marit., no. 153, p. 70.
 1833 *Latomus lapicida* Fitzinger, Syst. Verz., p. 97.
 1837 *Lenticula lapicida* Held in Isis, p. 913.
 1852 *Chilotrema lapicida* Leach, Syn. Moll., p. 77.
 1864 *Arianta lapicida* Mörch, Syn. Moll. Dan., p. 23.



Jules Colbeau

HISTORY.—*Helicigona lapicida* (*lapicida*, the stone-cutter) was first observed by Dr. Martin Lister, who designated it by the polynomial method then in vogue, although Linné in 1741 apparently found this species in an immature and albine condition amongst the calcareous rocks of the Vicklebyberg, in the Island of Oeland, and first distinguished it binomially as *Helix albella*.

This reference has, however, not been generally accepted, but all authors are agreed upon the accuracy of the allocation to the present species of *lapicida*, the name which Linné afterwards applied to the adult form, and his citation of the figures given by Dr. Martin Lister precludes all idea of error or misapprehension.

The name *lapicida* was probably bestowed by Linné in the belief that this species also disintegrated or perforated calcareous rocks in a similar manner to *Helix aspersa* and other species.

This remarkable and distinct species is associated with the late M. Jules Colbeau, of Brussels, one of the founders and the moving spirit of the Royal Malacological Society of Belgium, of which he was for very many years Secretary, who took a special interest in the present species, of which he published the fullest record of its range in Belgium, and also assiduously studied the variation and the geographical distribution of the mollusca of his country.

Diagnosis.—*H. lapicida* is sufficiently distinguished testaceologically from any other British species by its acutely angled periphery, continuous and detached peristome, and distinct lenticular shape, which has been likened to that of an antique lamp, but internally the relationship to its nearest ally *Helicigona arbustorum* is very intimate and striking, and the differences of organization are merely comparative.

Description.—The ANIMAL has its BODY obtuse anteriorly, tapering to a long, flat and pointed TAIL; the general tint of the body is a dark brownish grey, due to dark-brown tuberculation upon the dark-grey body, but towards the tail and the hinder part of the body the tint becomes paler and yellowish; the TUBERCLES are very regular, and uniform in size and arrangement, becoming more irregular and distant towards the rear; the DORSAL FURROWS are ill defined, but a noticeably paler dorsal area is very apparent, and is bounded by a darker lateral zone at each side, an appearance apparently partially due to the pigmented CEPHALIC RETRACTORS; lateral or GENITAL FURROWS very indistinct on the right side of the body, and not at all perceptible on the left side; no facial grooves, the tuberculation of the muzzle being quite uniform; SOLE yellowish-grey, with perceptibly darker margins, outer fringe yellowish; MANTLE dull leaden-grey, speckled with yellowish, with the margin of the RESPIRATORY ORIFICE yellowish; TENTACLES long and tapering, very bulbous at the end, and darkened by the retractors.

SHELL distinctly lenticular in shape, rather solid, subopaque and dull, of a yellowish-brown colour, marked transversely at intervals by faintly darker brown streaks, and sometimes by faintly-marked spiral banding; WHORLS $5\frac{1}{2}$, gradually increasing in size, and horizontally lenticular in section, with a strongly compressed periphery, continued as a very acute and distinct KEEL; the surface is beautifully shagreened by two series of closely arranged obliquely curved intersecting lines of TUBERCLES, these being distinctly perceptible on the paler embryonal whorl, but the arrangement is less noticeable on the larger whorls on which the granulation is much more pronounced; the BODY-WHORL is much more advanced in growth above than below, and abruptly deflected at completion, which renders the MOUTH obliquely horizontal; the PERISTOME is white, and forms a complete and detached rim of a transversely oval or lenticular shape, its lower margin being distinctly reflected, and the upper margin simply dilated; UMBILICUS large and open, showing the internal SPIRE

Diam. 17 mill.; alt. 7 mill. Average weight of adult about 7 grains.

EPIPHRAGM thin, transparent, and iridescent, with the calcareously encircled respiratory orifice placed near the top margin and towards the periphery; Dr. Gassies, however, describes it as very white and papyraceous.

INTERNALLY, the NERVOUS SYSTEM shows the same agglomeration of the nervous centres in the adults as in other species, but this is less marked in the young. The VISCERAL or parieto-splanchnic group has four distinct ganglionic

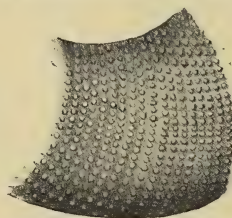


FIG. 452.—Sculpture of the embryonal whorl of *Helicigona lapicida*, $\times 25$ (based upon a photo. by Mr. W. Bagshaw).



FIG. 453.



FIG. 454.



FIG. 455.

FIG. 453.—Nerve ring of *Helicigona lapicida*, $\times 6$.

FIG. 454.—Ventral aspect of Nerve ring, showing the otocysts, $\times 6$.

FIG. 455.—Abnormal bifurcate ommatophore, showing by transmitted light the splitting of the olfactory nerve, greatly enlarged (after Van den Broeck).

a. olfactory nerve; b. its bulbous expansion, with the peripheral ramifications, c. c. c. c.; and h. branch to the bifurcation; g. the ocular nerve, showing the subterminal enlargement c., with eye f. at its distal end.

centres, but the space between the pedal ganglia and the visceral group is almost closed. The OTOCYSTS are placed, as in *Helix aspersa*, on the lower face of the pedal ganglia.

The HEART is small, the auricle and ventricle are both of a dirty-white, and scarcely distinguishable from each other by their colour.

The PEDAL GLAND, according to M. André, shows anteriorly a wide and flat excretory canal, with well developed folds on the roof of the cavity, and the usual conformation of ribs and grooves, but the cilia covering the canal are very short, and the glandular part is reduced to a few cellules; in the median portion the secretory cellules are somewhat compactly arranged, but the neighbouring lacunar system is not important.

The REPRODUCTIVE ORGANS show an ochreous OVOTESTIS, composed of loose follicles; the HERMAPHRODITE DUCT thick and much convoluted, and blotched with opaque-white; the VESICULA SEMINALIS or claw long, apparently closely doubled-up and sometimes crenulated; ALBUMEN GLAND narrowly linguiform, and of a dull amber colour; OVIDUCT white and woolly; SPERM DUCT pale ochreous; FREE OVIDUCT long and rather slender; PENIS SHEATH much distended towards the distal end; the RETRACTOR MUSCLE apparently attached near the base of the EPIPHALLUS and fixed at its root to the great muscle of the buccal mass; the FLAGELLUM is long and opaque-white, with two complete spiral twists at the base, and the spermatophore which is undoubtedly secreted therein, but is as yet unknown, will certainly partake of the same peculiar shape; the SPERMATHECA which arises from the free oviduct is roundish, of a yellowish colour, and often veined with red, borne upon a long and slender duct, with a stout diverticulum or branch which is sometimes cleft at the apex, but is scarcely as long as the spermathecal section, both branches being bound to the upper portion of the matrix by a broad and richly vascular membrane.

The MUCUS GLANDS are two in number, from 9 to 15 mill. in length, slender and vermiform in shape, but not stiff or rigid, widest towards the distal end, and two or three times longer than the dart-sac, which is embraced between them.

The DART-SAC or stylophore is long, slenderly cylindro-clavate in form, and of a semitransparent pearly-white at all ages; the DART or gypsobelum is $3\frac{1}{2}$ to 4 mill. in length, has a gently curved, slender, tapering stem, terminated by a much-flattened lanceolate head and a gradually expanded base.

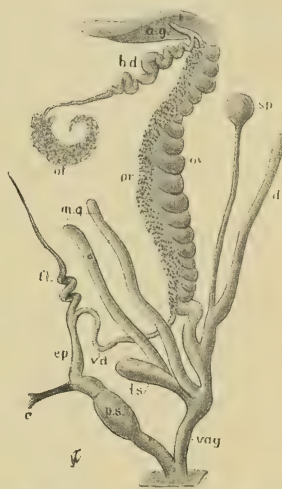


FIG. 456.—Reproductive organs of *Helicigona lapicida* (L.), $\times 2$.
 ot. ovotestis; h.d. hermaphrodite duct; pr prostate; v.d. vas deferens; fl. flagellum; ep. epiphallus; p.s. penis sheath; r. penial retractor; ov. sacculate oviduct; sp. spermatheca; d. its diverticulum; m.g. digitate mucus glands; d.s. dart sac; vag. vagina.



FIG. 457.



FIG. 458.

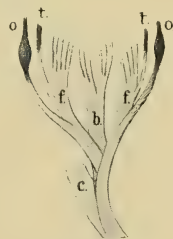


FIG. 459.

The Muscular and Reproductive organs of *Helicigona lapicida* (L.).

FIG. 457.—The gypsobelum or dart, with transverse section of head, $\times 6$.

FIG. 458.—The vesicula seminalis and the terminal portion of the hermaphrodite duct, $\times 10$.

FIG. 459.—The cephalic retractor and its branches.

b. buccal retractor; c. great columellar muscle; f. anterior pedal retractors; o. retractors of ommatophores; t. retractors of lower tentacles.

The CEPHALIC RETRACTOR arises very early from the great columellar muscle, the RIGHT TENTACULAR RETRACTOR having the earliest origin, and passing in its course between the male and female organs of the reproductive system to the right ommatophore; the retractor muscle of the left ommatophore arises from that of the right side near the base, but in this species both retractors are devoted mainly to the retraction of the anterior part of the foot, each detaching a slender branch to serve the lower tentacle of their respective sides; the broad strap-like BUCCAL RETRACTOR arises later, and on approaching the buccal bulb is deeply cleft, each branch subdividing for attachment to the buccal mass.

The ALIMENTARY SYSTEM is triodromous, and scarcely differs in its proportions from that of *H. rufescens*; the OESOPHAGUS is long and longitudinally striped, merging almost insensibly into the CROPH, which is long and cylindrical, but expanding somewhat in the region of the true stomach, which terminates the

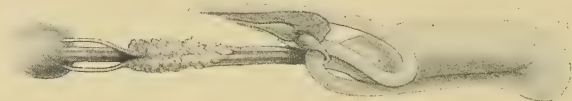


FIG. 460.—Alimentary organs of *Helicigona lapicida*, $\times 2$, showing also the salivary glands, renal organ, and heart, and the method in which the cephalic branch of the aorta loops the gut.

ingestive tract: the SALIVARY GLANDS are white and embrace the median portion of the oesophagus; the DUCTS are slender and about 5 mill. long; the DIGESTIVE GLAND is ochreous-yellow, and covered with brown blotches; the KIDNEY may be buff, veined with brown, or cream coloured with reddish-brown marks or blotches.

The JAW is about a millimetre in width from side to side, arcuate from front to back, and broadly crescentic in shape, being about half-a-millimetre from the upper to the cutting margin, and of a deep fawn colour, the ends abruptly cut off, and not rounded, with distinct but fine perpendicular and more delicate horizontal striæ; the vertical ribs are four or five in number, inconspicuous and flat and crenulate the upper and lower margins; there are also three or four darker lines of different lengths representing thickenings, subparallel to the upper and lower margins and to each other.

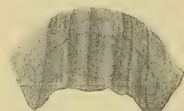


FIG. 461.—Jaw of *H. lapicida* $\times 20$
Castle Bolton, Yorkshire
(from photo. by Mr. W. Bagshaw).

The RADULA is long and narrow, about 5 mill. in length and $1\frac{1}{2}$ mill. in width, and composed of about 250 transverse rows of teeth, each row constituted by about 71 teeth, which include a well-developed unicuspid median tooth, bearing a very broad and strong mesocone, with no trace of accessory ectocones; the laterals are about fifteen in number, the admedians being simply obliquely unicuspid, but the tenth to fifteenth teeth are really transitional in character, and show traces of an ectocone about the tenth tooth, which rapidly develops as the teeth recede further from the median line; an endocone also becomes faintly discernible, but becomes suddenly very powerfully developed on the sixteenth tooth, and initiates the marginal series, which are usually about nineteen in number.

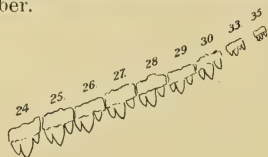


FIG. 462.—Representative denticles from the radula of *Helicigona lapicida*, highly magnified (from a photograph by Mr. W. Bagshaw of a preparation by Mr. J. W. Neville).

The teeth as they approach the outer edges of the membrane gradually decrease in size, and the endocone becomes almost equal in importance to the mesocone; while the ectocone becomes gradually distinct and almost equal in size, but at the outer margins tends to become bifid.

The formula of a Castle Bolton specimen, collected by Mr. W. Denison Roebuck and prepared by Mr. J. W. Neville, is

$$\frac{1}{3} \cdot 9 + \frac{1}{1} \cdot 5 + \frac{1}{1} + \frac{1}{1} \cdot 5 + \frac{1}{3} \cdot 9 \times 250 = 17,750 \text{ teeth.}$$

Reproduction and Development.—Nothing whatever is recorded of the sexual amenities of this species, but it is highly probable that the male element is transferred by means of a spermatophore spirally coiled in the manner indicated by the character of the flagellum wherein it is formed; Gassies has chronicled that the eggs are very small and white, about thirty in number, and deposited during June and July; but this also probably takes place much earlier, as young shells, six mill. in diameter, have been noticed by Dr. Weinland to be abundant during June in Wurtemberg. The shell in its immature stage greatly resembles that of *Helix explanata*, being very flat above and abruptly swollen below, and at this period is said to be the *H. complanata* of Schrank, and according to Dr. Gwyn Jeffreys is the *Helix somershamiensis* of Sheppard. It does not acquire its full development until the end of the following year.

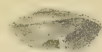


FIG. 463.—
H. lapicida, immature.
Dovedale.
Mr. C. T. Musson.

Food and Habits.—Few observations have been made upon the natural food, but the late Mr. Loydell is stated to have observed it feeding upon the foliage of Enchanter's Nightshade (*Circæa lutetiana*) at Brackley in Northamptonshire; Mr. F. Rhodes has noted them devouring Ivy leaves; Mr. F. Booth those of *Parmelia parietina*; and Mr. F. Morey records that at Shanklin, Isle of Wight, it has been noticed coming to "sugar" spread on the tree trunks for moths. They are also carnivorous on occasion, Mr. Charles Ashford having reported that a half-grown *H. lapicida* to get at the animal had bitten through the last whorl of a *Hyalinia cellaria* confined in the same box.

This species is especially sensitive to moisture, and its form is admirably adapted for concealment within the narrow cracks and crevices of rocks, etc., so that it is difficult and almost impossible to find in dry weather, but after continued or heavy rain the animal emerges and swarms over the rocks and walls, and ascends the trunks of the beech, sycamore, and other trees to a great height. In ordinary weather it feeds by night, and must be sought for at break of day, as in dry weather it quickly hides itself deeply in the rock crevices as the day advances. It carries its shell almost horizontally, but it may also be carried at an angle of 45° to 50° , and when the animal is in motion the lower margin of the shell touches the ground at each extension of the body.

This species especially favours limestone rocks and soils, but is not by any means confined to them, especially in the warmer and more genial districts, where it has been noticed commonly even on granitic and other primitive rocks, and about Angers, Maine-et-Loire, and also elsewhere, is exclusively found on the sandstone. It especially frequents old, ivy-covered walls and dry, lofty and exposed rocks and cliffs, in which there are an abundance of fissures or crevices, available for concealment and shelter from drought and enemies; it is also frequently found beneath the loose bark of old trees and even in hedges and ditch banks on the plains.

On the limestone hills of North Staffordshire, according to Mr. J. R. B. Masfield, it ascends to an altitude of more than 1,000 feet; and in the Pass of Winnats, Derbyshire, the Rev. R. A. Bullen found it at 1,250 feet.

In the mountains of Moravia and Silesia, it reaches to a height of about 2,000 feet. On Mont Dore in the Auvergne Mountains of Central France it ascends to nearly 4,000 feet; in the Pyrenees, at Cauterets, to 4,000 feet, the zone of *H. aspersa* and of the beech, and in another portion of the same range it approaches 5,000 feet, and inhabits the zone of *Helix fontenillei*.

Protective Resemblance.—The similarity of this snail to other objects has been noted by several observers; Mr. Cobbold exhibited at the meeting of the Essex Field Club a species of *Medicago*, the fruit of which so closely resembled a snail as to give it the name of the "Snail Plant," and which simulates the shell of *H. lapicida* so closely that the shell could scarcely be distinguished from the fruit.

Mr. J. F. Whiteaves has also remarked that he has found this species on bramble in Oxfordshire, and that it is difficult to detect in such situations, as the shell resembles in colour the dark purple hue of the plant; while Mr. Step has found that when at rest on beech trunks it is an exact counterpart of the low-knobbed excrescences on the smooth grey bark, and when affixed to the bottom framing of park palings it as closely resembles the heads of the iron bolts with which the framing is put together.

Geological Distribution.—Not as yet reliably found below the Pliocene strata, from whence it is reported by M. Locard; it is, however, present in many beds of later age over a considerable region.

The specimens from the Oligocene limestone beds at Sconce and elsewhere in the Isle of Wight, doubtfully referred to this species by Mr. F. E. Edwards, have here been regarded as another species, *Plectotropis tropifera*, which belongs to a group of mollusks formerly inhabiting the European region, but long ago expelled therefrom, and now finding refuge chiefly among the Asiatic Islands of the Eastern Pacific Ocean, which are its metropolis at the present day.

MIOCENE.—One example found by Wollaston at Zimbral d'Area, Porto Santo, Madeira, in the fossiliferous beds ascribed by Dr. Boog Watson to the Miocene age, but which M. Locard records as late Pleistocene.

PLIOCENE.—Recorded by M. Locard from the Lower Pliocene beds of Hauterive in the department of the Drôme, France.

OLIGOCENE.—Mr. W. G. Blatch has found specimens in the Barton beds in South Hampshire.

PLEISTOCENE.—In West Kent, it has been discovered in the Ightham fissure near Wrotham by Mr. W. J. Lewis Abbott.

In North Essex, it was recorded by Prof. Morris from the freshwater marls of Copford and Clacton. In South Essex, it has been recorded from Crayford, but according to Mr. B. B. Woodward probably erroneously.

In Cambridge, Mrs. McKenny Hughes records it from the gravel beds at Barnwell Abbey and at Grantchester.

In Germany, it is recorded from tufa at Weimar, Burgtonna, and Muhlhausen, Thuringia, by Dr. Sandberger; from the tufa at Streitberg, Franconia, by Dr. von Ihering; and the var. *grossulariæ* from Thuringian diluvium by Dr. Richter.

In France, it is recorded by Dr. Sandberger from the Upper Pleistocene at Clichy, Seine-et-Oise; by M. Locard from the deposits at Paris, the Somme Valley, and at Vallières-les-Grandes, Indre-et-Loire.

Drs. Grateloup and Raulin record it under the name of *Helix lapicidites* from the Aquitanian deposits, and as *Helix lapicida-minima* from those of Paris; M. Bouillet as abundant in the cellular Travertin, and in the Aragonite between Coudes and Montpeyroux, Puy-de-Dôme, and he also cites it from the breccia of Nîmes, Gard, on the authority of Brard; and from that of Nice, Alpes Maritimes, on the authority of M. de la Groye.

HOLOCENE.—Found in the tufaceous deposits at Blashenwell, Dorset, by Mr. J. C. Mansel-Pleydell.

In West Kent, it has according to Kennard and Woodward been found at the base of an interment of early Romano-British age in Stanley's Quarry, Ightham; and Mr. B. B. Woodward tabulates it as from the deposits at Crossness.

In Surrey, it is recorded from a depth of eighteen inches in the Horse-shoe Pit, at Reigate, Colley Hill, by the Rev. R. Ashington Bullen.

In North Essex, it has been found in the black earth and peat alluvial deposits of the River Cann, at Chignal, near Chelmsford, also in an alluvial bed disclosed by draining a field on Duke's Farm, Roxwell, by Mr. Miller Christy; and in the shell marl at Felstead by Mr. J. French. In South Essex, it is recorded by Kennard and Woodward as not common in a patch of alluvial shell-marl of the River Lea, near the south side of Lockwood Reservoir, Walthamstow; from the deposits on the Clapton side of the river, and also cited as found by Dr. F. Corner in the alluvial beds alternating with deposits of mud and peat disclosed during excavations at Canning Town.

In Cambridge, it has been found by the Rev. R. Ashington Bullen in the Romano-British deposit at Harlton.

In East Gloucester, it is recorded by Hinton and Kennard from the "old soil" beneath deposits of Roman age, from the "quarry tip," and from a depth of 2½ feet or more in King's Beeches Gravel Quarry, Cleeve Hill.

In Germany, Dr. von Ihering records it from the diluvial tufa at Ober Zaunsbach, Franconia.

In France, it is recorded by Comm. Caziot from the quaternary beds of Cap Martin, Alpes Maritimes; by M. Laville from the gravels of Joinville-le-Pont, Seine; by M. Tournouër in the tufa of the Celle, near Moret, Seine-et-Marne; by M. Cardot from the calcareous tufa of Melandry, Ardennes; and by M. Locard from the freshwater Molasse near Lyons.

In Belgium, M. Grégoire records it as rather common in the "Tourbe" at Uccle lez-Bruxelles, Brabant, and M. van den Broeck from alluvium at Ghent in East Flanders.

In Denmark, it is recorded by Dr. A. C. Johansen from the "kitchen-midden" at Meilgaard, Jutland; and from the Neolithic deposits at Stovaflejrig near Oxnebjerg in Funen.

Variation.—The variation of this species is not so remarkable as that presented by many species, but it is said to be loftier, smaller, and darker coloured in woods than on rocks and walls, the depressed forms being an especial adaptation for effective concealment in their chinks and fissures.

It is a form of shell which attains its maximum development in the North Pacific Islands, in *Cochlostyla listeri*, *C. rota*, etc., of the Philippine Islands, though the organization of *H. lapicida* is much more advanced than that of these more feebly endowed and more primitive Eastern Asiatic species, so similar in their outward form.

The most striking variation is that in which the carination is quite lost and the periphery rounded, as in *H. rufescens*, *H. cornea*, etc., which in general aspect it very much resembles, and which is attributed by Clessin to a deficiency of calcareous substances, though other observers deny that differences in geological strata effect any essential changes in the form of the shells living thereon.

The variations in spiral banding of this species has been hitherto greatly neglected, and although Dr. Westerlund includes it in his group *Paurotenia*, the species of which are characterized by never possessing more than four spiral bands, yet this is by no means fully ascertained as invariably the case, and we cannot therefore with safety, as yet, adopt a notation or formula, as has been done so admirably with the *Pentatwenia*.

VARIATIONS IN FORM OF SHELL.

Var. *ecarinata* A. Schmidt, Moll. Norddeutsche, 1857, p. 16.

Helix lapicida var. *subangulata* Pascal, Moll. Haute Loire, etc., 1873, p. 33.

Helix lapicida var. *grossulariæ* Voith (Westerlund, Prodr. Eur. Moll., 1878, p. 88).

SHELL with the whorls rounded at the periphery.

This variety when characteristic is very remarkable and resembles *Helix cornea*; the rounded periphery is ascribed by Clessin to the deficiency of calcareous matter.

The sub-var. *subangulata* has the last whorl rounded, though slightly angulate at the periphery, and resembles the typical form in colouring.

The sub-var. *grossulariæ* is described in almost identical terms.



FIG. 464.—
H. lapicida v. *ecarinata*
Dovedale,
Mr. C. T. Musson.

ENGLAND.

Devon—On a wall, Lynton, 1890, F. J. Partridge.

Sussex W.—Lavant, May 1904, Rev. W. A. Shaw.

Suffolk W.—Recorded as "var. without keel" from Sudbury (Loudon's Mag., 1835, p. 580).

Hereford—Sub-var. *subangulata*, Dormington Quarries, Boycott and Bowell, Woolhope Nat. Field Club, 1899.

Derby—Dovedale ! C. T. Musson. Buxton, Sept. 1900 ! F. Taylor.

CONTINENTAL DISTRIBUTION.

Germany—Recorded by A. Schmidt from Neuwied, Rhenish Prussia; from Mordingen near Freiburg, Baden, by A. Gysser; from Rödding, Schleswig, by Schlesch; by Brockmeier from Westphalia; and a slightly angulate form is figured by Dr. Weinland from Taitelwald, Wurtemberg.

France—Sub-var. *subangulata*, on the old walls of the Tower of Roderie near Puy, Haute Loire (Pascal, l.c.).

Var. *explanata* Locard, Mal. Lyon., 1877, p. 27.

Helix lapicida var. *lecoquii* Moquin-Tandon, Hist. Moll. France, 1855, vol. ii., p. 138.

Helix lapicida var. *medelpadensis* Clessin, Mal. Bl., 1879, p. 15.

Helix lapicida var. *depressa* Beaudouin, Mal. Chatillon sur-Seine, 1888, p. 396.

SHELL flat above, and convex below the periphery.

The var. *explanata* s.s., has the shell completely flat above, like *H. explanata*, and is of a somewhat yellowish-white colour.

The sub-var. *depressa* is described as possessing a very flat spire.

The sub-var. *medelpadensis* is described as smaller, spire very flat, convex below. Diam. 17 mill.; alt. $5\frac{1}{2}$ mill.

The sub-var. *lecoquii* is described as smaller, flat above, less carinate and pale.

ENGLAND.

Monmouth—Chepstow, June 1880 ! C. T. Musson.

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *lecoquii* recorded for Alsace by Meyer.

France—Var. *explanata*, Lyons, Locard. Sub-var. *depressa*, Chatillon-sur-Seine, Côte d'Or, Beaudouin. Sub-var. *lecoquii* is very common in the Haute Loire, according to Pascal; Moquin-Tandon records it from Wildenstein, at the foot of the Rotenbac, Vosges; and Grateloup from the Auvergne.

Switzerland—Sub-var. *depressa*, Lucerne, 1904, Hugh Watson.

Sweden—Sub-var. *medelpadensis*, rare on the slag-heaps, Galtström, Medelpad, C. G. Anderson (Mal. Bl., 1880, p. 152).

Var. **convexa** Baudon, Moll. Oise, 1862, p. 19.

Helix lapicida var. *pyramidata* Pascal, Moll. Haute Loire, etc., 1873, p. 33.

Helix lapicida var. *pseudo-scalaria* Locard, Mal. Lyon., 1877, p. 27.

Helix lapicida var. *elata* Beaudouin, Mal. Chatillon-sur-Seine, 1888, p. 396.

SHELL with a very convexly elevated spire.

The var. **convexa** s.s., is described as possessing a dark shell, with a convex spire, and often a blunted keel.

The sub-var. **pyramidata** is very convex above, resembling a flattened pyramid, somewhat convex beneath, and very strongly carinate.

The sub-var. **elata** Beaudouin is described as having a risen spire.

The sub-var. **pseudo-scalaria** is described as much more risen in the spire than the type, and the colour olive-brown, with brown flammules.

ENGLAND.

Hereford—Messrs. Boycott & Bowell record distinctly subconoid specimens from Aymestry, Dormington Quarries, and Backbury.

CONTINENTAL DISTRIBUTION.

France—Var. **convexa** is rather abundant in shady places, under fallen leaves, and on the trunks of beech-trees, Forest of Hez, Oise (Baudon, l.c.). Sub-var. *pyramidata* is recorded by Pascal from about Puy, Haute Loire. Sub-var. *elata* from Chatillon-sur-Seine, Côte d'Or, by Beaudouin; and sub-var. *pseudo-scalaria* from about Lyons by Locard.

VARIATIONS IN SUBSTANCE OF SHELL.

Var. **subpellucida** Baudon, Journ. de Conch., 1884, p. 252.

SHELL small, thin and of a semitransparent horny colour, with few and scarcely visible darker flammules.

ENGLAND.

Devon N.—Lynmouth, Sept. 1907, W. H. Wood. Lynton, April 1908 ! A. H. Jowett-Murray.

Hants. S.—Racton, Jan. 1898, C. E. Wright.

Kent E.—Ewell Wood, Dover, June 1895 ! Lionel E. Adams.

CONTINENTAL DISTRIBUTION.

Germany—Sandberger records very thin shelled specimens from the Black Forest and from the Spessart in Franconia.

France—Rare, Forest of Hez, Oise (Baudon, l.c.). Rare about Salins, Côte d'Or (Wattebled, Journ. de Conch., 1889, p. 317).

VARIATIONS IN SIZE OF SHELL.

Var. **major** Pfeiffer, Mon. Hel. Viv., 1848, i., p. 371.

SHELL larger, and sharply keeled.

The var. **major** s.s. is described as diam. maj. 21 mill., min. 18½ mill.; alt. 8 mill.; that of Pascal as 22 mill. in diam., and 7 mill. in alt.; and Westerlund's as 20 mill. in diam., and 9 mill. in alt.

CONTINENTAL DISTRIBUTION.

France—Common throughout the Haute Loire, according to Pascal.

Var. **minor** Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 138.

SHELL smaller. Diam. 12 mill.; alt. 7 mill.

The var. **minor** of Pascal is described as 13½ mill. in diam., and 6 mill. in alt.; that of Westerlund as 12 mill. in diam., and 5-6 mill. in alt.; and Borcharding gives 11-13 mill. in diam., and 5 mill. in alt.

ENGLAND.

Hants. N.—Preston Candover, 1884, Rev. H. P. Fitzgerald.

Worcester—Cleeve Prior, 1886 ! B. M. Oakeshott.

Surrey—Common on a wall, Downside, Epsom (J. E. Daniel, Sc. Goss., 1879).

Haslemere, C. Pannell, Moll. Haslemere, 1903.

Somerset N.—Weston-super-Mare ! specimens in the British Museum.

Derby—Common at Allport (C. Clare Fryer, Sc. Goss., Nov. 1890, p. 242).



FIG. 465.—

H. lapicida var. *minor*
Preste, France.
Mr. G. K. Gude.

CONTINENTAL DISTRIBUTION.

Germany—Recorded from near Lippe-Detmold by Borchherding; and by Gysser from Belchen, and the Renchthal near Freiburg, Baden.

Belgium—Villers, Brabant, E. van den Broeck.

France—Common throughout Haute Loire according to Pascal; Moquin-Tandon records it from Rodez, Aveyron, and Toulouse, Haute Garonne; Locard as rather rare on the mountains of Parves in Bugey, and the woods above Hauteville, Ain; M. Bouillet from the Mont Dore district, Puy-de-Dôme; and Dr. Daniel from Jetée-de-Camaret, Finistère. Preste, Pyrénées Orientales! G. K. Gude.

Norway—Asker near Christiania, and Bamble near Langesund, Miss Esmark.

Switzerland—B. M. Oakeshott.

VARIATIONS IN COLOUR OF SHELL.

Var. *albina* Menke, Syn. Moll., 1830, p. 24.

Helicigona (Chilotrema) lapicida var. *alba* Steenberg, Landsnegle, 1911, p. 102.

SHELL uniformly whitish, with a greenish or yellowish tinge.

This beautiful variety, unrecorded in this country in 1862, is now of frequent occurrence; and when immature is the *Helix albella* of Linné; the *H. albella* of Dr. Fleming, which was based upon a dead shell picked up on the shore at St. Andrew's, Fifeshire, was considered by Dr. Jeffreys as identical with that of Linné.

ENGLAND.

Devon S.—On walls, Culverhole, Aug. 1882, Lionel E. Adams.

Devon N.—Valley of East Lyn near Lynmouth, 1865! W. Whitwell. Messrs. Beeston and Wright give the proportion of the white variety to the typical form in this locality at about $3\frac{1}{2}$ per cent. Lynton, April 1908! A. H. Jowett-Murray.

Somerset N.—On a loose, ivy-covered stone wall, on the old Bristol road, just outside the city of Wells, May 1887! Rev. S. Spencer Pearce. One specimen found near Leigh Court, Miss F. M. Hele.

Hants. N.—Preston Candover, 1884! Rev. H. P. Fitzgerald.

Hants. S.—Christchurch, June 1896; and Racton, Jan. 1898! C. E. Wright.

Sussex W.—Light greenish-white specimens, Lavant, May 1904, Rev. W. A. Shaw.

Middlesex—Found fairly commonly about sixty years ago on a rough wall in the Zoological Gardens, Regent's Park, by Mr. R. D. Darbishire.

Surrey—Reigate, G. S. and E. Saunders. Haslemere (C. Pannell, l.c.).

Kent E.—On a birch trunk, Ewell, near Dover, Lionel E. Adams.

Lincoln S.—Not uncommon on a stone wall of Great Oolitic limestone at Carlby near Bourne! first found there by Mr. T. Stow in July 1904.

Northampton—Brackley, A. Loydell.

Gloucester E.—Cranham, F. Taylor.

Derby—A colony at Matlock, Aug. 1879, T. Glover; and found in that district by many other collectors. Several in Dovedale, A. H. Jowett-Murray. Old walls on hill-side to the north of Monsal Dale Station, R. D. Darbishire.

York S.W.—Mr. J. Hebden, of Sandal near Wakefield, first found this variety in England at Went Vale near Pontefract.

York Mid W.—Grimbalds Crag, Knaresborough (J. Blackburn, Nat., 1866, p. 98).

Durham—Durham, Mrs. Fitzgerald.

CONTINENTAL DISTRIBUTION.

Germany—Recorded from Malsburg, N. Westphalia by Dr. Carl Pfeiffer; from Falkenburg, Hanover; and Bentheim, Osnabruck by Borchherding; from Hohen-Wittlingen, Wurtemberg by Dr. Weinland; from Carlsruhe, Baden by Gysser; from Rödding, Schleswig by Schlesch; from Fulda by Dr. Speyer; from Burg, Nassau by Dr. Koch; and from the Lower Harz by Dr. Gwyn Jeffreys, etc.

Belgium—Recorded from Hastière in Namur by Van den Broeck.

France—Recorded from Chatillon-sur-Seine, Côte d'Or, by Beaudouin; from Preste, Pyrénées Orientales, by Massot and Dupuy; from environs of Puy, Haute Loire, by Pascal; from Orange, Vaucluse, and Dranguignan, Vosges, by Moquin-Tandon; from the Canterets, Hautes Pyrénées, by Dupuy; from St. Laurent, Ain, by J. R. le B. Tomlin; from Bourg-d'Oisans, Chartreuse, etc., Isère, by Dr. Albin Gras; from Alsace by Herr Meyer; from Savoy at Salève and abundantly at St. Gervais les Bains by Dr. Brot; and the Valley of the Dranse by Dr. Gwyn Jeffreys.

Switzerland—Recorded by Charpentier from Lausanne, and from between St. Maurice and Bex in Canton Vaud; from Berne at Iseltwald in 1868 by M. Roffiaen; from Spiez by Hugh Watson; and from Stein-on-Rhine, Schaffhausen, by Tomlin.

Spain—Recorded from Catalonia at Montserrat by Zulueta; and from the Valley of the Segre by Nicolai.

Denmark—M. Steenberg cites this variety as found in Denmark.

Var. **flavescens** Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 138.

SHELL pale yellowish, without markings.

CONTINENTAL DISTRIBUTION.

France—Reported by Moquin-Tandon from near Rodez, Aveyron; and by Locard from Vassieux near Lyons, Rhône.

Var. **rufa** Germain, Moll. Maine et Loire, 1903, p. 113.

SHELL of an uniform ferruginous-red, without brown maculations or markings, the two earliest whorls lactescent.

CONTINENTAL DISTRIBUTION.

France—Rare about Angers, Maine et Loire (Germain, l.c.).

Var. **nigrescens** Taylor, Journ. of Conch., 1883, vol. iv., p. 83.

SHELL of an uniform, very dark, brownish-black, with a paler apex, and a white peristome.

ENGLAND AND WALES.

Somerset S.—On walls, Ham Hill, Yeovil, Aug. 1909! J. H. Ponsouby.

Somerset N.—Abundant about Rimpton, E. W. Swanton.

Surrey—Haslemere, C. Pannell.

Herts.—Tring, July 1910! C. Oldham.

Norfolk E.—Framingham Earl, Rev. S. Spencer Pearce.

Northampton—A large colony on limestone wall, Oundle, July 1906; also at Markholm, April 1903; and Giddington, Jan. 1904, C. E. Wright.

Gloucester W.—Westbury near Bristol, Aug. 1883! Miss F. M. Hele.

Derby—A large colony, very dark in colour and of large size at Ambergate (T. Hey, Journ. of Conch., 1889, p. 121).

York N.E.—Hawby Hill, Ryedale, Aug. 1889! W. Denison Roebuck.

York Mid W.—Malham, June 1883! W. West. Skipton, J. R. le B. Tomlin. Abundant at Grass High Wood, Grassington, Sept. 1906! F. Booth.

York N.W.—West Burton, near Aysgarth, Aug. 1911! E. Collier.

CONTINENTAL DISTRIBUTION.

Germany—On trees, Neckar-Steinach, Baden, Aug. 1910! Dr. E. O. Croft; and Wachwitz, Saxony, 1904, F. H. Sikes.

VARIATIONS IN MARKINGS OF SHELL

Var. **fasciata** Taylor, var. nov.

SHELL showing darker spiral banding.

The sub-var. **tetrafasciata** has three bands above the periphery and one below.

The sub-var. **trifasciata** shews two bands above the periphery and one below.

The sub-var. **bifasciata** shews two bands, one above and one below the periphery.

The sub-var. **unifasciata** has a single band, above the periphery.

The sub-var. **infraciata** has only a single band, which is below the periphery.

ENGLAND.

Somerset S.—Sub-var. *infraciata*, Wells! Rev. S. Spencer Pearce.

Somerset N.—Sub-var. *infraciata*, Leigh Woods, 1878! Miss F. M. Hele.

Derby—Mr. C. Clare Fryer records single banded shells from Allport; some were suprafasciate (sub-var. *unifasciata*) the band occupying a position above the periphery corresponding to that of band 3 in *Helix nemoralis*, etc., while in others (sub-var. *infraciata*) the band occupied the position of band 4 below it.

CONTINENTAL DISTRIBUTION.

Germany—Dr. O. Boettger has recorded thin shelled specimens shewing four bands (sub-var. *tetrafasciata*) from Zeitlofs in Wilden Weinstein, Lower Franconia; Herr Clessin describes the shell in Germany as ordinarily possessing three feebly developed bands (sub-var. *trifasciata*) and Merkel agrees that this is the normal form in Silesia. The sub-var. *infraciata* on beech trees, by Uklei See, Holstein, July 1888!

France—The sub-var. *bifasciata* with bands occupying the position of the 3rd and 4th bands in the pentatæniæ formula, found at Bordeaux, Gironde, by Dr. Scharff.

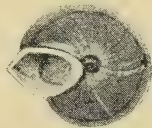


FIG. 466.—*H. lapicida* sub-var. *infraciata* Taylor. Wells, Somerset. Rev. S. Spencer Pearce.

Var. radiata Gassies, Mal. Agenais, 1849, p. 102.

Helix lapicida vars. *fulva* and *grisea* Moq.-Tand., Hist. Moll. France, 1855, pp. 137-8.
Helix lapicida var. *fulvo-maculata* Locard, Mal. Lyonn., 1887, p. 27.

SHELL radiately marked with brownish on a paler ground tint.

The var. *radiata* s.s. is radiately marked with clear horny and brown, and is probably the var. β of Draparnaud.

The sub-var. *grisea* is described as ashy-grey, with reddish markings, and is the var. γ of Draparnaud.

The sub-vars. *fulva* Moquin-Tandon and *fulva-radiata* Locard are described as "clear fawn with ferruginous markings," and are the var. α of Draparnaud.

ENGLAND.

Gloucester W.—Sub-var. *fulva*, walls near Bristol, 1885 ! Miss F. M. Hele.

York N.W.—Sub-v. *grisea*, West Burton, nr. Aysgarth, Aug. 1911 ! E. Collier.

CONTINENTAL DISTRIBUTION.

Germany—Specimens in the British Museum from Pymont, described by Prof. Cockerell as "light brown, with dark brown markings."

France—Var. *radiata*, Lot-et-Garonne (Gassies, l.c.).

Sub-var. *fulva*, recorded by Moquin-Tandon from Rodez, Aveyron ; Dijon, Côte d'Or ; Grasse, Alpes Maritimes ; and Orange, Vaucluse ; by Pascal from near Orsay and Valley of the Yvette, Seine-et-Oise ; as common in low grounds in the Ain, by Locard ; as rare on summit of the Mont Poupet, Côte d'Or, by Wattebled ; and on Mont Dore, Puy-de-Dôme, by Bouillet.

Sub-var. *grisea*, Preste, Pyrénées Orientales ! E. Collier. Recorded by Moquin-Tandon from Finistère ; from near Rodez, Aveyron ; from Grande-Chartreuse, Isère ; from Moselle ; from Vienne ; and from Pyrénées Orientales. M. Pascal reported it from the Valley of the Borne, Haute Loire, and from Orsay and other places in Seine-et-Oise ; Abbé Dupuy records a whitish or yellowish variety, flammulated with fawn, in the Pyrénées Orientales ; M. Puton describes a whitish variety with obscure rufous markings in the Vosges ; and M. Bouillet affirms its existence in Puy-de-Dôme, in the valley of Mont Dore, and on the mountains in its vicinity.

MONSTROSITIES.

Monstr. sinistrorsum Westerlund, Exp. Moll. Suède et Norv., 1871, p. 44.

SHELL reversed in coiling.

ENGLAND.

Devon N.—On a wall at Lynton, 1890, F. J. Partridge.

CONTINENTAL DISTRIBUTION.

France—Perpignan, Pyrénées Orientales (Moq.-Tan., Hist. Moll., i., p. 321, 1855).

Sweden—Bungenäs, Isle of Gothland (Westerlund, l.c.).

Monstr. scalare Charpentier, Moll. Suisse, 1837, p. 9, pl. i., f. 8.

Helix (Chilotrema) lapicida monstr. *scalariforme* Adams, Collector's Man., 1896, p. 59.

SHELL with whorls more or less disjoined.

The sub-var. *subscalaris* of Grateloup has the dislocation of the whorls less pronounced.

ENGLAND.

Somerset N.—Rimpton ! E. W. Swanton.

Sussex W.—Lavant, May 1904, Rev. W. A. Shaw.

Kent W.—Ewell Wood, Dover, Lionel E. Adams.

CONTINENTAL DISTRIBUTION.

Germany—Rödding, Schleswig (Schlesch, Ann. Soc. Mal. Belg., 1907, p. 47).

Belgium—Dinant, Namur, collected by Major le Hon (Broeck, Ann. Soc. Mal. Belg., 1870, p. 41, pl. ii., f. 3).

France—Monstr. *scalare* is recorded by Dr. Grateloup for the north of France, and the monstr. *subscalaris* from Clermont, Auvergne, and from Ste. Croix-du-Mont, and Bordeaux.

Switzerland—Near Villeneuve, Canton Vaud (Charp., l.c.).

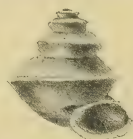


FIG. 467. — *Helicigona lapicida* m. *scalare* Ch., Dinant, Belgium. (after Van den Broeck).

Geographical Distribution.—This species has a very compact range in West Central Europe, its area extending from Mid Sweden in the north to Cintra in the south, and from Portugal in the west to the north shores of Lake Ladoga in the east; yet it is by no means universally distributed throughout the whole region, but is most plentiful in wooded and rocky districts, or amongst the mountain ranges, and rare or absent in the low-lying plains, and though usually favouring limestone soils, is by no means confined to them, as under otherwise favourable conditions it may be found living almost indiscriminately on other formations.

The especial adaptation of this species to a rocky environment results in a lessening of its adaptability and power to prosper amidst other more generalized surroundings, and thus tends to retard the extension of its geographical range.

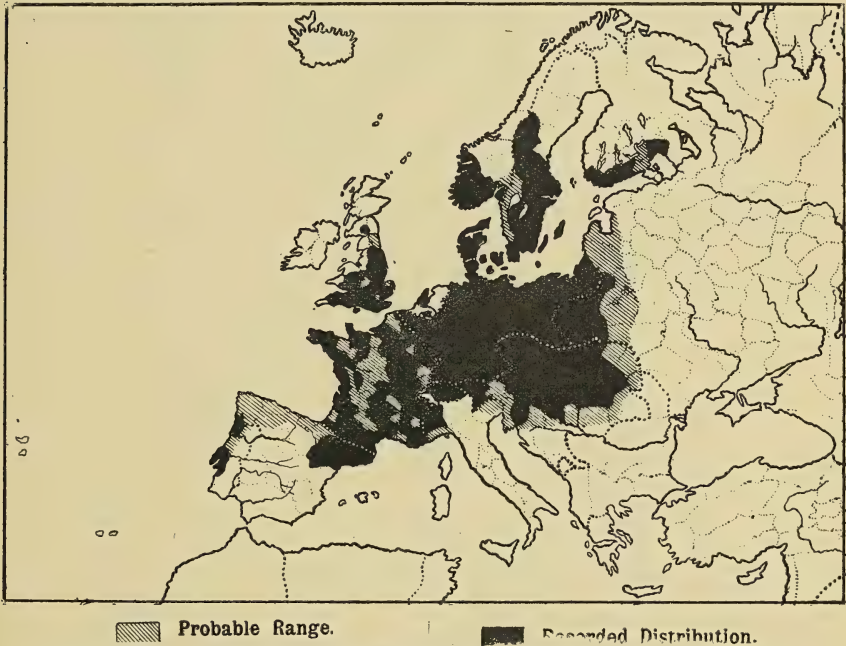


FIG. 468.—Geographical Distribution of *Helicigona lapicida* (L.).

H. lapicida has been reported from Germany, Holland, Belgium, France, Spain, Portugal, Denmark, Sweden, Norway, Switzerland, Austro-Hungary, Poland, Finland, and East Russia.

It is also recorded from Sicily by M. Locard and others, but the record is an improbable one.

In the British Isles, its natural area of habitation is restricted to the eastern counties of Wales, and the south, east, and central counties of England, as defined by a line extending from the north-west of Yorkshire to the western confines of Devonshire, beyond which are certain outliers where the species has been artificially introduced or erroneously recorded, as the Orkney Isles and various points in Ireland; but these localities are almost certainly erroneous, and do not represent the natural range of the species, which is a well defined and continuous tract.

ENGLAND AND WALES.

PENINSULA.

Cornwall W.—Recorded by Dr. Leach as not uncommon near Padstow.

Devon S.—Not uncommon on the borders of Dartmoor (Leach, Synopsis, p. 77). Under stones of a dry wall in fields above Goodington Sands, 1854 ! E. Parfitt. Abounds on walls, Ashburton, 1884 ! E. D. Marquand. On beech trees, Knowle, Lustleigh, Oct. 1886, Miss L. J. Gould. Woolborough, near Newton Abbot, May 1892, A. Reynell. Fairly common about Teignmouth, L. St. G. Byne.

Devon N.—Valley of the East Lyn, near Lynmouth, 1865 ! W. Whitwell. Lynton, Capt. Bruce Hutton (Jeffreys, Brit. Conch., 1862, p. 228).

Somerset S.—Local and rare on dolomitic conglomerate, by the River Tone near Wellington, April 1909 ! but abundant on the sea-cliffs, close down by the shore at Minehead, April 1909, W. Gygell. On a wall at Ham Hill, near Yeovil, Aug. 1909 ! J. H. Ponsonby.

Somerset N.—Recorded by Da Costa in 1778 as found about Bath ; and from Leigh Woods in 1822 by Mr. J. S. Miller. In 1860, Rev. Canon Norman described it as apparently confined to the limestone rocks, and as found near Wells, Cheddar, Wrington, Clevedon, Cleeve Toot, St. Vincent's rocks, Axbridge, Elton Hills, Cadbury Hill near Yatton, etc. Weston-super-Mare, May 1885 ! C. G. Barrett. Abundant at Rimpton on old walls, and at foot of gate-posts far distant from walls ! E. W. Swanton.

CHANNEL.

Wilts. N.—Corsham and Roundway Hill (J. E. Vize, Wilts. Mag., 1866, p. 279).

Wilts. S.—Salisbury (J. E. Vize, l.c.). Only at Stert Valley, near Devizes ! C. D. Heginbotham. Dinton ! Hugh Wyndham. Edington, 1905 ! E. W. Swanton.

Dorset—Recorded in 1799 by Dr. Pulteney as found in the crevices of limestone rocks and on rotten trees in woods ; and by Colonel Montagu in 1803 as not uncommon on the top of the hill in Portland Island. The chalk cliffs of the White Nore, R. Damon, 1884. Corfe Castle, Aug. 1884, Sydney C. Cockerell. Swanage and Spettisbury, June 1884 ! Charles Ashford. Undercliff, Emmett's Hill, common, 1882 ! Rev. S. Spencer Pearce. Anvil Point, Aug. 1907 ! W. E. Brady.

Isle of Wight—Most common in the south of the island, and only recorded in the northern part amongst rejectamenta of the stream flowing into Gurnard Bay. In the southern part it is found under stones in damp places at the Landslip, Bonchurch, A. J. Hambrough. Pelham Wood, Ventnor, G. Guyon ; and plentiful under stones on the downs ! W. H. Heathcote. Appuldurcombe ! Charles Ashford. Common about Shanklin, H. F. Poole. Totlands, 1886 ! J. W. Wood. Abundant at St. Lawrence, G. T. Woods. The Undercliff, John Taylor.

Hants. S.—Recorded from Southampton by Donovan. Winchester, Aug. 1883 ! J. R. le B. Tomlin. Common on old wall by Priory Church, Christchurch, Oct. 1884. Beaulieu Abbey, Aug. 1885 ! under felled timber near Holmsley, Sept. 1885 ; and Petersfield, March 1886, Charles Ashford. On beech trees, Finchdean, May 1896 ; Netley Abbey ; Racton and Stoke Down, Jan. 1898, C. E. Wright. Lavant, 1905, Rev. W. A. Shaw.

Hants. N.—Preston Candover, Oct. 1883 ! Rev. H. P. Fitzgerald. Winchester, Aug. 1883 ! J. R. le B. Tomlin. Swarraton, May 1885 ! Rev. W. L. W. Eyre.

Sussex W.—Worthing, Oct. 1883, B. M. Oakeshott. Near Bognor, Aug. 1884, T. D. A. Cockerell. Dale Park, Slindon, Mar. 1893, A. Reynell. Selsea, Apr. 1903, F. H. Sikes. Miscombe Hanger, C. E. Wright.

Sussex E.—Silverhill, Hastings, June 1901 ! R. C. Harrison. Warbleton, 1903 ! F. H. Sikes.

THAMES.

Kent W.—Da Costa in 1778 records that this species was found by Petiver in hedges between Carlton and Woolwich ; Daniel Cooper in 1836 its finding at Lewisham and between Charlton and Blackheath ; and R. H. S. Smith in 1854 its frequent occurrence at Sevenoaks, especially on the chalk. Bickley, May 1883 ! St. Mary Cray, Aug. 1884 ; Orpington and Greenhithe, June 1885 ! T. D. A. Cockerell. Rochester road, Gravesend, Sept. 1888 ! H. W. Kew.

Kent E.—On beech trees, Throwley, Sept. 1877, Miss Fairbrass. Canterbury, March 1885 ! L. B. Ross. Chalk pit, near Shorne, G. K. Gude. Near Dover, Aug. 1888 ! Rev. Canon Horsley. Walls of Richborough Castle, May 1888 ! W. Whitwell. Folkestone, Sept. 1881, Thomas Ruddy. Minster, Isle of Thanet, April 1883, T. D. A. Cockerell. Charing and St. Margaret's, July 1886 ; Maidstone, Sept. 1903 ; and in hedgerows, Shepherdswell, July 1896, C. E. Wright.

Distribution of *Helicigona lapicida* (L.).

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.

Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilts N.	48 Merioneth
8 Wilts S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TRENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid
21 Middlesex	HUMBER
22 Berks.	61 S.E. York
23 Oxford	62 N.E. York
24 Bucks.	63 S.W. York
ANGLIA	64 Mid W. York
25 Suffolk E.	65 N.W. York
26 Suffolk W.	TYNE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Hunts.	69 Westmorland
32 Northampton	and L. Lancs.
SEVERN	70 Cumberland
33 Gloucester E.	71 Isle of Man
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easternness
76 Renfrew	W. HIGHLANDS
77 Lanark	97 Westernness
E. LOWLANDS	98 Main Argyle
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Cantire
81 Berwick	102 Ebnides S.
82 Haddington	103 Ebnides Mid
83 Edinburgh	104 Ebnides N.
84 Linlithgow	N. HIGHLANDS
85 E. HIGHLANDS	105 Ross W.
86 Fife & Kinross	106 Ross E.
87 Perth S. & Clkn.	107 Sutherland E.
88 Mid Perth	108 Sutherland W.
89 Perth N.	109 Caithness
90 Forfar	NORTH ISLES
91 Kincardine	110 Hebrides
92 Aberdeen S.	111 Orkneys
	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenney
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

- Probable Range.
- Recorded Distribution.
- Distribution verified by the Author.
- Geological Distribution.

Surrey—Recorded by Da Costa in 1778 from “the moss on the bodies of large trees and in woods”; and by G. S. and E. Saunders at Reigate on beech trees on the downs. Common at Haslemere, 1878 ! and plentiful at Caterham, 1879 ! Rev. S. Spencer Pearce. Box Hill, Aug. 1883, E. H. Rowe. Guildford; Shirley Common, Aug. 1884; Warlingham, May 1883, T. D. A. Cockerell. Chalk bank near Limpsfield, March 1891; and hedgebank, Burford Bridge, near Mickleham, June 1901, A. Reynell. Sutton and Banstead, Oct. 1902, F. H. Sikes.

Essex S.—Dead shells, Doddington, March 1884 ! R. Miller Christy.

Essex N.—Recorded by James Carter as found in 1833 in hedges and gardens about Witham. Saffron Walden, 1852-60, C. Ashford. Rare at Chignal St. James, Aug. 1883 ! R. Miller Christy. Sible Hedingham, Aug. 1890, L. E. Adams.

Herts.—Beech woods, Tring, Miss Selby. On stumps in hedges, Sandridge, A. F. Griffith. Ware, Sept. 1886 ! and Tring, July 1910 ! C. Oldham. Bishop Stortford, July 1891, E. E. Ingold. Aldenham, Rev. A. H. Cooke.

Middlesex—Fairly common about sixty years ago on a rough wall in the zoological gardens, Regent's Park, R. D. Darbishire.

Berks.—Fairly common in hedges on gravelly soil, Maidenhead, June 1880, L. E. Adams. Reading, May 1885 ! C. G. Barrett. Beech woods, Bradfield, Oct. 1906, Rev. E. Peake.

Oxford—Recorded by H. E. Strickland in 1834 as frequent on beech stems about Henley-on-Thames; and by Rev. Canon Norman in 1853 as not uncommon in woods at Watlington. Beech woods, Howe Combe, May 1909 ! W. Denison Roebuck. Wall near Charlbury; and common on beech trees near Evring, Aug. 1883 ! Rev. S. Spencer Pearce.

Bucks.—High Wycombe, H. Ulyett. Common at Marlow, 1875 ! Rev. S. Spencer Pearce. Monk's Risborough, 1901, Prof. Weldon. Amersham, Feb. 1905, F. H. Sikes.

ANGLIA.

Suffolk E.—Abundant near Southwold, Aug. 1883, A. F. Griffith. Upper Hellesdon, 1891 ! and Needham Market, Oct. 1902, A. Mayfield. Eye; and on oak trunks, Homersfield, April 1907, G. T. Rope.

Suffolk W.—Recorded eighty years ago as frequent about Sudbury (London's Magazine). Milden ! A. Mayfield. Fakenham Magna, 1905, F. H. Sikes.

Norfolk E.—Common in hawthorn hedges about Thorpe and Dunston, near Norwich (W. K. Bridgman, Zool., 1851, p. 3303). On stone walls, Bramerton and Thorpe, March 1886, T. Reeve.

Cambridge—Fen Ditton, June 1909 ! Hugh Watson.

Bedford—Limbury, April 1885 ! J. Saunders.

Hunts.—Clay lane, Alconbury ! Abbot's Ripton ! and Cow lane, Little Stukeley, 1899, Rev. R. Ashington Bullen.

Northampton—Recorded in 1712 by Morton as found “in hedge-bottoms on the west side of Oakley parva, by the road to Stanian.” Castle Ashby on lime trees, Dec. 1878 ! and Yardley Hastings, Sept. 1885 ! R. Rogers. In hedges, Barton, April 1896; Hornstock Wood, Jan. 1904; a large colony, Oundle, July 1906; and in hedgerows, Deenethorpe, June 1907, C. E. Wright.

SEVERN.

Gloucester E.—Many on the limestone rocks, but commoner on the beech trees in nearly all the woods about Cooper's Hill, Cheltenham (Webster, Nat., 1854, p. 137). Rendcombe (Bellars, Brit. Shells, 1858). Plentiful, Stroud, Aug. 1884 ! E. J. Elliott. Gloucester, Oct. 1879, Rev. H. Milnes.

Gloucester W.—Generally distributed on walls, etc., about Bristol, Miss F. M. Hele. Common on the cliffs, Clifton, May 1866 ! W. Nelson. Long Ashton, Aug. 1884 ! J. R. le B. Tomlin. Roadside, Staunton, July 1891 ! W. Whitwell.

Monmouth—In great abundance about Chepstow, E. J. Lowe. Plentiful on mountain limestone, Tintern, Apr. 1884 ! C. T. Mussion. Wyndcliff, F. H. Sikes.

Hereford—Abundant in beech woods, Ross, July 1885 ! Rev. R. W. J. Smart. Belmont, Hereford, Oct. 1886 ! C. B. Plowright. Local and uncommon, Doward Hill, Dormington, A. E. Boycott. Symond's Yat, July 1891 ! W. Whitwell.

Worcester—Enumerated for Malvern (Griffiths, Malvern List, 1870). Morley's Nursery, Balsall Heath, Aug. 1877 ! W. Nelson. Cleeve Prior, abundant, May 1883, W. H. Boland. Common, Habberley Valley, 1886, B. M. Oakeshott.

Stafford—Abundant on the limestone; and at Hezley Castle (Garner, Staff., 1844, p. 301). Dovedale, Sept. 1884 ! F. B. Webb. Beeston Tor near Wetton, April 1885 ! E. D. Bostock.

Salop—One dead shell amongst débris of Wenlock Shale at Edge Wood, Church Stretton (Buddicom, Moll. Ch. Strett., 1904).

SOUTH WALES.

Glamorgan—Llantwit-Major and Cowbridge, common ! F. W. Wotton.

Brecon—Llanerchoeddland Wells and Clydach, April 1909 ! F. H. Sikes.

Radnor—Plentiful on Silurian slate rocks at Water-break-its-neck, Aug. 1881 ! C. T. Musson. Aberedw churchyard, Sept. 1907, C. Oldham.

NORTH WALES.

Montgomery—Breidden Hill, Welshpool, May 1887 ! J. Bickerton Morgan.

TRENT.

Lincoln S.—Dr. Martin Lister in 1678 recorded it as often found in the woods of Lincolnshire, in winter under the bark of old trees and among the grass in the summer. Harrowby lane, Aug. 1885 ! Abney wood, Grantham, 1903 ; Ropsley Rise, May 1904 ! J. Hawkins. On trees, Uffington, Sept. 1885 ! E. Collier. Understones on wall tops, Great Ponton, June 1895 ! H. Preston. Abundant, Sapperton, Sept. 1904 ! and Carby, Aug. 1905 ! T. Stow.

Lincoln N.—Broughton Woods, June 1877, H. Franklin Parsons. Grisel Bottom, Burwell Wood, Sept. 1889 ! W. Denison Roebuck. Well Vale, Alford, June 1890 ! J. Burt Davy. Greetwell Iron Mines, July 1906 ! and Welton-le-Marsh, Aug. 1908 ! J. F. Musham.

Leicester and Rutland—Osgathorpe ! Rev. C. E. Y. Kendall.

Notts.—On magnesian limestone, Cresswell Crags ! Pleasley Vale ! Kirkby-in-Ashfield, and Beauvale Abbey ; and on Keuper clay at Egmont and Halloughton near Southwell ! also at Debdale near Mansfield, July 1884 ! C. T. Musson. Mansfield Woodhouse, April 1882, E. Pickard.

Derby—DaCosta in 1778 records it as found on the rocks at or near Matlock. Miller's Dale, Oct. 1877 ! H. Crowther. On rocks, Dovedale ; Castleton ; Cresswell Crags, and Pleasley Vale, 1878 ! C. T. Musson. Buxton, May 1878 ! T. W. Bell. Haddon Hall ! and South Wingfield, 1883 ! on the short grass by wayside, Ashover, May 1882 ! L. E. Emmet. Markland Grips, April 1882, E. Pickard. Chee Dale, May 1883 ! and Wormhill, Oct. 1891 ! W. West. Monsal Dale, Sep. 1885 ! E. Collier. Cavedale, Sept. 1885 ! J. R. Hardy. Monksdale, May 1888 ! T. Hey. Beresford Dale at Wolfscote, April 1890, Lionel E. Adams. Pass of Winnats, 1,250 feet alt., Aug. 1900, Rev. R. Ashington Bullen.

HUMBER.

York S.E.—North Grimston, 1883 ! J. Ingleby.

York N.E.—Hambleton Hills near Thirsk (J. W. Watson, Nat., 1854, p. 85). Hawby Hill, common, Aug. 1884 ! W. Denison Roebuck. Gormire, abundant, Oct. 1882 ! Percy Lund. Very abundant, Sutton Bank, Vale of Mowbray, July 1887 ! W. Foggitt. Malton ! W. Bean. Scarborough (Theakston's Guide to Scarborough, 1871, p. 176). St. Mary's Abbey, York, G. E. Hastings.

York S.W.—Anston Crags near Sheffield, April 1882, Edgar Pickard. Denbydale on sandstone, rare, J. Wilcock. Clayton West, J. Beevers. On limestone cliffs, Went Vale, May 1864 ! W. Nelson.

York Mid W.—Grimbald's Crag, Knaresborough, and Wetherby, Sept. 1866, J. Blackburn. Jackdaw Crag, Boston Spa, Oct. 1870 ; Saw Wood ! and Thorner, May 1878 ! Bolton Abbey and Threshfield, Aug. 1868 ! W. Nelson. Hartwith, June 1880, F. T. Walker. Birstwith, Oct. 1888 ! F. R. Fitzgerald. On walls, Starbottan, May 1886 ! Troller's Gill, April 1887 ! Kilnsey Scar and Kettlewell, July 1882 ! also on walls, How Stean Beck, May 1886 ! W. Denison Roebuck. Burnsall, April 1884 ! W. Storey. On ruined walls of Fountains Abbey, June 1870 ; and Appletreewick, June 1882, Gordale Scar and Little Gordale, Sept. 1878, G. Roberts. Tanfield, and near North Stainley, Oct. 1866, J. Blackburn. Malham, Oct. 1866, G. H. Parke. Kirkby Malham, 1887 ; and Rilston, 1886 (Sopham & Carter, Moll. Airedale, 1888). Clapham (W. E. Collinge, Nat., 1890, p. 113). Mickley, J. Dalton. Hammerton near Clitheroe, Sep. 1885 ! R. D. Darbshire. Grass Wood, Grassington, Sept. 1906 ! F. Booth.

York N.W.—Richmond, May 1877 ! also Askrigg, Aysgarth, and near Hawes, Aug. 1882 ! Henry Crowther. On walls, Bolton Castle, and Scarth Nick, Leyburn, Aug. 1882 ! W. Denison Roebuck. Wensley, Sept. 1885, W. Webster. Coverdale, 1887 ! R. C. Chaytor.

TYNE.

Durham—Introduced by the Rev. Mr. Laws at Tunstall Hill near Sunderland, where it was found later by Mr. R. Howse, and may still exist there.

Northumberland—DaCosta records in 1778 that it had been found on the rocks in Northumberland by Mr. Wallis.

LAKES.

Isle of Man—Recorded as scarce by Mr. R. Garner (Midl. Nat., Apl. 1878).

SCOTLAND.

Roxburgh—Formerly found on Weensland road, Hawick ! but the locality is now destroyed by building operations, W. Grant Guthrie.

Orkneys—Enumerated as found by Dr. T. Stewart Traill (Edinb. Enc., 1830, p. 10).

IRELAND.

Dr. Leach in his Synopsis, published in 1852, describes this species as not uncommon in the south of Ireland ; but this is apparently quite erroneous, as the only ascertainable, though incorrect, records appear to be that by Brown in 1818, who ascribed Belfast as a locality on the authority of Dr. McDonnell, but that gentleman's specimens were English ones ; and by Dr. Turton, who stated that specimens had been "found by Mrs. Travers of Belgrove on the stone steps of her mansion at Cove," Cork.

It was included by Mr. J. E. Palmer in a list of captures in Kildare during 1884, and according to Thompson was introduced into the vicinity of Limerick in 1839.

GERMANY.

Ranges throughout the empire, especially in the mountainous regions, but is local and rare on the plains. It occurs in Alsace, Anhalt, Altenburg, Baden, Bavaria, Bavarian Palatinate, Brandenburg, Brunswick, Bremen, Cassel, Coburg, Darmstadt, Franconia, Gotha, Hanover, Hesse, Holstein, Lippe-Detmold, Lorraine, Luneberg, Mecklenburg, Merseburg, Nassau, Oldenburg, Osnabruck, Pomerania, Posen, East, West, and Rhenish Prussia, Pymont, Saxony, Schleswig, Silesia, Suabia, Thuringia, Weimar, Westphalia, Wurtemberg, and the Islands Rugen and Wollin.

NETHERLANDS.

Holland—Reported by Heer Schepmann from Bloemendaal near Haarlem, North Holland ; and as recorded by Ubaghs from Maastricht and Geulem in Limberg.

Belgium—Recorded by M. Colbeau from various localities in Brabant, Hainault, Liège, Limburg, Luxemburg, Namur, and the Grand Duchy of Luxemburg ; while Van Broeck records it from alluvial deposits at Ghent in East Flanders.

FRANCE.

Recorded by Moquin-Tandon and others as diffused over nearly all France, but is unrecorded from a great area of the interior region, records only being known from Ain, Aisne, Alpes Maritimes, Allier, Ardennes, Ariège, Aube, Auvergne, Aude, Aveyron, Basses Alpes, Basses Pyrénées, Calvados, Charente Inférieure, Cantal, Côte d'Or, Côtes du Nord, Drôme, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Haute Marne, Hautes Pyrénées, Hérault, Isère, Jura, Loire Inférieure, Lot-et-Garonne, Lozère, Maine-et-Loire, Meuse, Morbihan, Moselle, Nièvre, Nord, Oise, Orne, Puy-de-Dôme, Pyrénées Orientales, Rhône, Saône-et-Loire, Sarthe, Savoy, Seine, Seine Inférieure, Seine-et-Marne, Seine-et-Oise, Somme, Var, Vaucluse, Vendée, Vienne, and Vosges.

ITALY.

Restricted to the north-west, and only recorded by Signor Pollonera from the mountainous region of Piedmont at Monginevra, and in the Valle della Doria Riparia, at an altitude of from 1,600 to 2,700 feet at S. Bertrand near Susa.

A single specimen is said to have been found at Catania in Sicily by Aradas and Maggiore, but the record is probably erroneous.

SPAIN AND PORTUGAL.

Spain—Only known from Aragon and Catalonia, in both of which it has been recorded from many localities. It was reported by Ramis from the Balearic Isles, but according to Dr. Hidalgo in error, the specimens being *H. nyelii* Mittré.

Portugal—Only reported from Oporto in Minho, and Cintra in Estremadura.

AUSTRO-HUNGARY.

Apparently diffused all over the empire except the extreme eastern and southern districts, and is recorded from Upper and Lower Austria, Bohemia, Carinthia, Carniola, Galicia, Hungary, Moravia, Styria, Tyrol, and the Vorarlberg.

SWITZERLAND.

Distributed throughout the whole confederation, and records are known from Aargau, Appenzell, Basle, Berne, Geneva, Glarus, Grisons, Lucerne, Neuchatel, St. Gall, Schaffhausen, Solothurn, Thurgau, Uri, Valais, Vaud, and Zurich.

SCANDINAVIA.

Norway—Probably common in the south, but not extending beyond 61° north lat. It has been recorded in Christiania Stift from Christiania, Asker, Lier, Modum, Ringerije, Sandefjord, and as abundant on the islands in Christianiafjord. In Christiansand Stift it is known from Langesund, Skien, Telemarken, and Lillesand; also from Sognefjord in Bergen Stift.

Sweden—According to Dr. Westerlund, this species is diffused throughout Southern and Central Sweden, extending to about 63° north lat., and though more especially found in the calcareous districts, also occurs though more rarely on the more primitive rocks. It has been recorded as occurring in the provinces of Blekinge, Dalarna, Gestríkland, Jamtland, Nerike, Ostergotland, Skane, Smaland, Stockholm, Upland, Westergotland, Westmanland, and the Islands of Oeland and Gotland.

Denmark—Distributed over Jutland and the islands, and is recorded by Steenberg as existing on the Islands of Zealand, Funen, Laaland, Moen, Langeland, Falster, and Bornholm, and in Jutland ranging from Fredericia to Aalborg.

RUSSIA.

Only known in Russia from Poland and Finland, though probably inhabiting one or more of the Baltic Provinces.

Poland—Said by Slosarski to be common in mountainous places, and especially mentioned as occurring at Ojców, Olsztyn, Złoty Potok, and Mont Ste Croix.

Finland—According to Luther, it is restricted to the southern provinces, and is recorded from the Åland Isles, the limestone tracts of the province of Åbo, the porphyritic rocks of Hogland, and at the marble quarries of Ruskeala, to the north of Lake Ladoga, and approaching to 62° north lat.

ATLANTIC ISLES.

Madeira—Recorded by Dr. Gwyn Jeffreys and other writers on the authority of Mr. T. V. Wollaston, but only a single fossil shell has as yet been found.

NEARCTIC REGION.

United States—Mr. W. G. Binney records that in 1837 he imported many specimens from England, which he liberated in his garden at Burlington, New Jersey, but that they disappeared almost immediately.



FIG. 469.—Carboniferous limestone wall, bounding Grass High Wood, Grassington, Yorks., where *H. lapicida* var. *nigrescens* is common.

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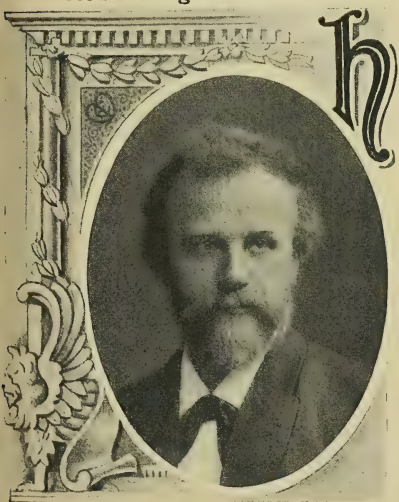
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SUB-GENUS *Arianta* Leach.***Helicigona arbustorum* (Linné).**

- 1674 *Cochlea subflava, maculata, atque unica fascia castanei coloris per medium anfractus insignita* Lister, Phil. Trans., vol. ix., p. 99, no. 105, f. 4.
 1678 *Cochlea maculata, unică fasciâ pullâ, angustioreq: per medium anfractûs insignita* Lister, Hist. An. Angl., p. 119, tit. iv., tab. 2, f. 4.
 1740 *Cochlea testa utrinque convexa subcinerea: fascia solitaria grisea, labro reflexo* Linnæus, Fauna Suecica, vol. i., p. 370, no. 1295.
-
- 1758 *Helix arbustorum* L., Syst. Nat., ed. x., p. 771, no. 596.
 1777 — *rufescens* Pennant, Brit. Zool., iv., p. 134, pl. 85, f. 127.
 1819 — (*Helicigena*) *arbustorum* Fér., Hist. Nat. Moll., pl. xxvii., ff. 5-8.
 1828 — *turgidula* Wood, Index Test., Suppl., pl. vii., f. 6.
 1833 — *canigonenis* Boubée, Bull. Hist. Nat. Moll., no. 57, p. 36.
 1834 — *xatartii* Farines, Bull. Soc. Hist. Nat. Perpignan, ff. 7-9.
 1835 — *picea* and *alpestris* Ziegler in Rossm., Icon., vol. i., p. 57, f. 297B and f. 297D.
 1837 — *rudis* Mühlf. in Rossm., Icon., vol. i., p. 6, pl. v., f. 78.
 1837 — *alpicola* Charp., Moll. Suisse, p. 6.
 1840 — *planospira* Gras, Moll. Isère, p. 36, pl. 3, f. 11.
 1848 — *wittmanni* Zawadsky in Pfeiffer, Mon. Hel. Viv., p. 340.
 1860 — *æthiops* Bielz, Verh. Mitth. Siebenb. Ver., p. 221.
 1868 — (*Campylæa*) *styriaca* Frauenfeld, Verh. Zool.-Bot. Ges. Wien., p. 149.
 1882 — *repellini* Charp., Locard, Prodr. Mal., p. 59.
 1882 — *hypnicola* Mabilie, Bull. Soc. Philom. Paris, p. 7.
 1882 — *fagoti* Bourguignat in Locard, Prodr. Mal., pp. 66 and 306.
 1883 — *camprodunica* Kobelt, Icon., p. 37, f. 108.
 1883 — *cirsiphila, elaphra, thamnivaga, themita* Mabilie, Bull. Soc. Philom. Paris, p. 382 et seq.
 1889 — *alpinula, corneoliformis, dravica, illusana, jetschini, musdorfensis, stentzi, trochoidalis & vibrayana* Serv., Bull. Soc. Mal. Fr., p. 378 et seq.
 1889 — *albulana, feroeli, knitteli, nazarina* and *trachia* Bourguignat in Servain, Bull. Soc. Mal. France, p. 394 et seq.
 1778 *Cochlea unifasciata* Da Costa, Test. Brit., p. 75, pl. 17, f. 6.
 1833 *Arianta arbustorum* Leach, Brit. Moll., p. 86.
 1837 *Cingulifera arbustorum* Held, Isis, p. 911.
 1894 *Helicigona arbustorum*, Pilsbry, Manual of Conchology, pt. 36, p. 296.



Prof. Eduard von Martens

HISTORY.—*Helicigona arbustorum* (*arbustorum*, living in copses), though binomially distinguished by Linné, was first noticed and described by Dr. Martin Lister, the real pioneer of the science of Conchology. On account of the great variability of this species, numerous names have been bestowed upon it by Mabilie, Servain, and others, who elevated to specific rank a number of forms which are probably more correctly regarded as varietal only.

With this species I have associated my late valued friend and correspondent, Prof. Eduard von Martens, of Berlin, the most distinguished conchologist of his time, who selected this species for the present purpose as the first he collected, it being very abundant by his home at Stuttgart and a form in which he always retained a lively interest.

The recent discovery by Mr. Edgar A. Smith that the type specimen of *Helix rufescens* of Pennant is not the species to which that name is usually allocated, but is a young shell of *H. arbustorum*, places Pennant's name in the foregoing synonymy, and may unfortunately necessitate another name being used for the species hitherto known as *H. rufescens*.

According to Kuster it is also the *Helix castanea* of Muhlfeldt.

This species is now usually placed by systematists in the sub-genus *Arianta*, a group established by Dr. Leach, the name according to the Rev. G. A. Frank Knight being based upon that of Ariantas, a king of Scythia, who employed arrows to take a census of his people, the name therefore probably having reference to the arrow-shaped love-dart of this and allied species. The North American species formerly referred to this group are simulating forms of more primitive organization.

Although the description given by Linné (Syst. Nat., ed. xii., 1766) is in many respects unsatisfactory, yet his reference to Lister's figures, the presence of specimens in the Linnean Collection now in the possession of the Linnean Society, and the acceptance of the identification by his contemporaries and successors, justify the acceptance of the name.

Description.—The ANIMAL is usually dark grey or black-brown in colour, varying to different shades of grey and brown, and occasionally to a delicate fawn; but as in many other species, the colour of the body has no relation to that of the shell; there is a slightly paler area along the mid-dorsal line, and the whole body is overspread by thirteen or fourteen oblique forwardly directed rows of distinct tubercles, which, though irregular in shape when the body is contracted, become elongate when the animal is in motion; the DORSAL GROOVES are indistinct, but the two mid-dorsal rows of tubercles are elongate; there are no facial grooves, and the lateral groove is not perceptible on either side of the body; the MANTLE is said to be reddish-brown or dusky, with numerous milk-white specks; FOOT-MARGIN and FOOT-SOLE pale greyish tinged with yellow, and indistinctly tripartite; TAIL abruptly pointed, pale yellowish-grey, similarly but more delicately tuberculate than the anterior part of the BODY; OMMATOPHORES very long and distinctly bulbous at the end, of a translucent yellowish-grey, but darkened by the presence of the pigmented RETRACTORS, and overspread with fine and distant darker granulations; LOWER TENTACLES semi-transparent yellowish-grey, about one-third the length of the upper pair and swollen at the tips.

The shell is carried in various positions when the animal is in motion, sometimes vigorously upright, at others almost horizontally.

The SHELL is usually somewhat globular, but more convex above than below, of a rich brownish colour, freckled with opaque yellowish or reddish markings, and with a single dark brown supra-peripheral band encircling each whorl; the shell is strongly and sometimes irregularly sculptured by the lines of growth, and finely and closely striate or incised in a spiral direction; EPIDERMIS rather thin, but sometimes duplex on the body whorl, the outer layer being usually brown and very deciduous; WHORLS 5-6, convex and without evidence of a keel; SPIRE somewhat blunt; SUTURE rather deep; MOUTH forming about two-thirds of a circle; OUTER LIP thick, white and reflected, sometimes strengthened by an internal rib, much inflected above and rounded below; INNER LIP a mere film; UMBILICUS small and oblique, nearly concealed by a fold of the outer lip.

Diam. 20 mill. ; alt. 16 mill. Average weight of shell 8 grains.

The EPIPHRAGM is very thin, transparent, and iridescent; the small calcareous area is opposite the respiratory orifice and close to the outer margin.

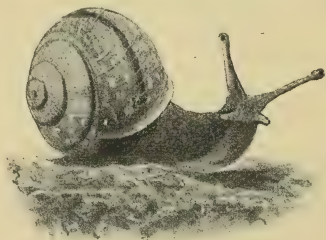


FIG. 471.—*Helicigona arbustorum* in motion showing the mode of carrying the shell (Photo. by Mr. G. C. Spence).

INTERNALLY, the PERICARDIUM is of dull grey, minutely spotted; the HEART is four mill. long, the AURICLE being grey, and the VENTRICLE of an opaque light grey. The ŒSOPHAGUS is white, the DIGESTIVE GLAND or liver is chestnut brown, and the OTOCYSTS each contain more than one hundred otoconia.

The CEPHALIC RETRACTORS as dissected by Miss Lebour show an almost common origin of the BUCCAL and TENTACULAR retractors; the buccal strand is fairly long and broad, becoming bifid before attachment to the buccal bulb, and somewhat basally gives off an auxiliary muscle to the left tentacular retractor.

The right tentacular retractor is a strong strap-like muscle, which a little beyond half its length gives off from its inner side a strong divaricating branch to the anterior part of the foot, from the basal part of which branch the long, slender deeply pigmented muscle serving the anterior tentacle arises and also gives off a slender filament to the lip. The left retractor in this preparation differs from that of the right side, by the anterior tentacular branch being distinct and separate, and in giving rise to two separate bundles of powerful muscles directed to the foot.

The REPRODUCTIVE ORGANS show the characteristic features of the *Helicigona*; the OVOTESTIS is placed in the early whorls of the shell, with the lobes of the liver or digestive gland; the DUCT is rather long, at first simple and direct, but soon becoming tortuous and convoluted; the ALBUMEN GLAND is narrowly linguiform and light buff in colour; SPERM DUCT light buff and much narrower than the oviduct; SPERMATHECA oval, duct or stem semitransparent and slender, but dilated basally; DIVERTICULUM thick, considerably longer than the spermatheca and its duct, and bound to the uterus by a wide and richly vascular membrane; VAGINA inflated below; PENIS-SHEATH distally thickened and comparatively short, continued as an EPIPHALLUS, and terminating in a long and slender FLAGELLUM, which forms three complete spiral twists at its base—a striking peculiarity quite omitted in Moquin-Tandon's illustrative figure; the long RETRACTOR MUSCLE is attached to the median portion of the epiphallus and its distal end fixed near the base of the mantle flap.

The MUCUS GLANDS are paired, and enclose between them the stylophore or dart-sac; they are stout, stiff, simply subulate organs, varying from 15–25 mill. in length, tough, as thick as the dart-sac, and tapering to a blunt but occasionally bifid point, thus initiating the ramified organ of the true *Helices*; they vary in colour, and though white in immature individuals, when mature are usually grey, tinged with a dull shade of green, blue, purple, ochre, or even livid-brown, and besprinkled with minute spots or streaks of dusky-brown, a coloration sometimes shared by the dart-sac.

The STYLOPHORE or dart-sac is cylindrically clavate and whitish during growth, and only becomes pigmented as maturity is approached. Externally the sac is obscurely transparent-grey, and minutely spotted, but the internal walls may be purplish or reddish-brown, this colouring being perceptible through the outer envelope gives it the bluish-grey or livid aspect characteristic of the functionally mature sac.



FIG. 472.—Cephalic retractors of *H. arbustorum* $\times 2$ (from a dissection by Miss Marie V. Lebour).

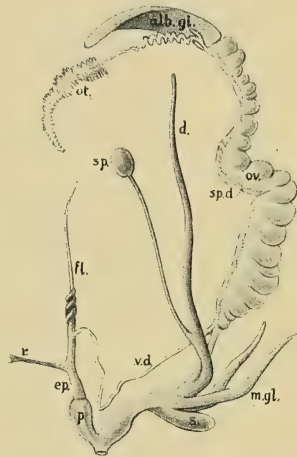


FIG. 473.—Reproductive or sexual organs of *Helicigona arbustorum* $\times 1\frac{1}{2}$.

alb. gl. albumen gland; s. dart sac; sp. spermatheca; sp. d. sperm duct; v. d. vas deferens; d. diverticulum; ep. epiphallus; fl. flagellum; m. gl. mucus glands; ov. oviduct; ot. ovotestis; p. penis sheath; r. penis retractor.

The GYPSOBELUM or dart varies in size in different individuals and varieties from three to five mill. in length, and is rarely absent from adult shells between the months of May and August, probably indicating it as more persistently retained than in some other species.



FIG. 474.



FIG. 475.

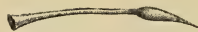


FIG. 476.

FIG. 474.—Fully mature Gypsobelum or "Love-dart" of *Helicigona arbustorum* $\times 3$.

FIG. 475.—Section through the lenticular head $\times 7$.

FIG. 476.—Gypsobelum or "Love-dart," scarcely mature $\times 7$.

When fully mature, the dart has a beautifully curved and hollow shaft, expanding below into a funnel-shaped base of attachment, without any distinct traces of a basal annulus; towards the free-end the stem abruptly enlarges to form a substantial, compressly lanceolate head, which at full maturity occupies more than a third of the entire weapon, and is lenticular in transverse section, gradually tapering to a fine terminal point.

Though in different individuals the darts are subject to a considerable amount of variation in size and relative proportions of parts, yet they are always calcareous and opaque, of a beautiful glistening white, and when immature are always slighter and more delicate throughout, the base less inflated, the head smaller, and its angles more acute and sharply pointed.

The SPERMATOPHORE or capreolus is a firm and spirally twisted, flatly filiform body of a greenish-brown colour, with apparently overfolded edges, which becomes



FIG. 477.



FIG. 478.

FIG. 477.—Imperfect Spermatophore of *Helicigona arbustorum*, extracted from the diverticulum of the spermatheca (greatly enlarged).

FIG. 478.—Spermatophore within the diverticulum, partially disintegrated (greatly enlarged).

brittle and rigid by exposure to the air. It has three complete spiral coils, which probably terminate in a straight slender extension at each end, the whole forming a very perfect replica of the flagellum and adjacent part of the epiphallus within which it is moulded.

The JAW or mandible is 0.75 mill. high and 2 mill. from side to side, strong and substantial, dark brown in colour, and rather flatly lunate in form, but varying considerably in the amount of curvature, with bluntly rounded or angulated ends, and very convex from front to rear. Though somewhat variable in number, there are usually five vertical or slightly divergent projecting ribs on the anterior face, which strongly denticulate both margins, but others less prominent may be interposed between the more developed ridges or may contribute to fill the area towards

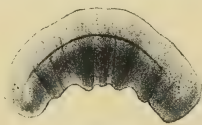


FIG. 479.

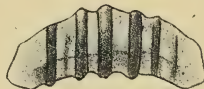


FIG. 480.

FIG. 479.—Mandible or jaw of *Helicigona arbustorum* $\times 8$. Selby (from a micro-photograph by Mr. W. Bagshaw of a preparation by Prof. Gwatkin).

FIG. 480.—Mandible or jaw of *Helicigona arbustorum* $\times 8$. Beverley (from a preparation by Mr. J. D. Butterell).

the outer extremities. In the Selby specimen figured, there is a pair of slightly divaricated and strongly developed submedian ribs enclosing between them a well developed though narrower central one, while two other less prominent ribs occupy the outer area; these teeth all strongly denticulate the lower or cutting margin, while the smooth outline of the upper margin is only slightly influenced in contour by the two subcentral ridges.

The minute sculpture is composed of horizontal wavy incremental lines, and there are also vertical or perpendicular lines of striation.

The ODONTOPHORE or radula is of the usual oblong shape, about 6 mill. long and 2 mill. wide, bearing 120 or more slightly oblique transverse rows of teeth, each row composed of about 79 or more denticles arranged bilaterally in three series.

The median row is constituted by a longitudinal series of symmetrical obscurely trifid teeth, of which the mesocone is strong and powerful while the acute ectoconic points are but slightly developed.

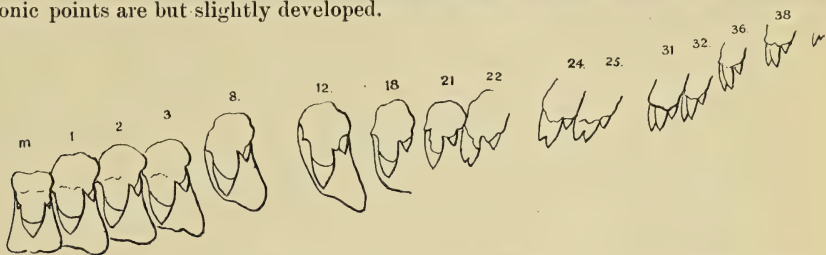


FIG. 481.—Representative denticles from the radula of *Helicigona arbustorum*, Selby, Yorks. (based on a photograph by Mr. W. Bagshaw of a preparation by Rev. Prof. H. M. Gwatkin).

The laterals are about twenty in number and bicuspidate, they have a wide basal plate of attachment, but as usual are deficient of the inner angle, and they resemble the median row in possessing a strongly developed mesocone which is asymmetrically placed on account of the complete atrophy of the endocone and the increasing development of the ectocone.

The marginals are nineteen or more in number and are indicated by the bifurcation of the mesoconic point and the comparative increase in the size and importance of the ectocone, which towards the outer margin tends to become bifid also, but occasionally the extreme outer marginals are simply acicular.

The formula of a Selby specimen, collected by Mr. J. F. Musham and prepared by Rev. Prof. H. M. Gwatkin, is

$$\frac{1^9}{3} + \frac{2^0}{2} + \frac{1^3}{3} + \frac{2^0}{2} + \frac{1^9}{3} \times 120 = 9,480 \text{ teeth.}$$

Reproduction and Development.—Although the amorous coquettings of this species have apparently never been observed or chronicled, yet Mr. Guy Breeden has observed and photographed the congress of this species, showing the shells during the act as arranged side by side, and the fore-part of the animals turned towards each other, so that their right sides were somewhat approximate, the interlaced exerted organs visibly connecting them together. The pairing season has been noticed to extend from the beginning of April quite into the autumn months, while the type form has been observed mating with the var. *flavescens* and even in congress with *Helix nemoralis*, but no record has been made of the results of such unions. The seminal element is transferred by means of the spirally twisted or corkscrew-shaped spermatophore, which after pairing becomes lodged in the spermathecal diverticulum of the companion snail where it speedily disintegrates.

The eggs, which are laid in small clusters at the roots of Coltsfoot and other plants, are thirty to fifty or more in number, spherical in shape, and of an opaque yellowish colour, though semitransparent when deposited. They are about three mill. in diameter, and laid from April to September, being said to hatch in fifteen to twenty days, passing the winter in the immature stage, young shells being usually plentiful during the autumn months, attaining their full growth in the following spring and summer months. During the growth and development of the shell and prior to the rest periods, the free edge of the aperture of the shell may be thickened at each cessation of growth by a somewhat yellowish-white calcareous deposit or submarginal rib, as in *H. pisana*, which in the adult show externally as transverse yellowish bands encircling the whorls and destitute of the mottled markings and band characteristic of the species.

Food and Habits.—*Helicigona arbustorum* is a very hardy species, enduring greater cold, and extending further north as well as to a greater altitude in the mountains than *Helix hortensis* and other allied species, the var. *betta* reaching a height of 9,000 feet in Northern Italy, so that in the more extreme districts the reproductive and growth seasons are crowded into the space of a few weeks in each year.

It has the reputation of being an indolent yet sensitive species, but it carries its shell more erect and higher than *Helix nemoralis* and travels at a greater speed. It yields mucus rather plentifully, adhering strongly to smooth surfaces, and though preferring darkness and obscurity, flourishes well in confinement, young shells being easily grown to maturity.

It is more nocturnal in habit than either *Helix nemoralis* or *H. hortensis*, and frequents moist and shady woods, as well as riverside meadows, particularly amongst willows and alders, where the soil is black and boggy, but is especially attached to hedgerows fringed with succulent herbage, nettle beds or by damp ditches overgrown with Ivy, Coltsfoot, and other plants, and even when freely crawling about usually keeps deep down amongst the herbage.

This species is not so skioptic or so acutely susceptible to shade as are *H. hortensis* and *H. pisana*, which are more markedly sensitive thereto; it is, however, very muscular, and according to the experiments of Mr. Henry Crowther, can ascend a vertical glass plate at a speed of 7 mill. per minute when carrying a weight of $8\frac{1}{4}$ grammes.

It is very responsive to moisture, and is most frequently found on the shady sides of hedgerows and woods, and crawls freely about on the warm damp mornings after copious dews, or after a heavy fall of rain. It is a very local and gregarious species, and quite geophilous, and although found commonly on old lichen-covered walls and on shrubs, does not habitually ascend trees.

In larch forests, where it is sometimes found, it is said, like *Helix foetens*, to contract an unpleasant odour.

H. arbustorum is believed to be purely herbivorous, and has been found feeding upon half-decayed vegetation, Nettles (*Urtica*), Thistles (*Cnicus*), Garlic (*Allium*), Coltsfoot (*Tussilago farfara*), Cow Parsley (*Heracleum*), Wild Parsnip (*Pastinaca sativa*), Alexanders (*Smyrniolum olusatrum*), Meadow Sweet (*Spiraea ulmaria*), Butterbur (*Petasites officinalis*), etc.

In confinement, Dr. Gain offered this species 190 different plants or foods, of which 51 were totally rejected even after a period of starvation; 62 kinds were nibbled more or less, while 75 were taken quite freely, but only strawberries and raw onions were eaten with avidity and zest. Amongst the foods freely taken were the Clovers (*Trifolium*), while the Trefoils (*Lotus*), were rejected; the Oak, the Hazel and other trees were eaten, but the Beech was rejected; many cultivated vegetables and several fruits were also devoured, but Apple was left untouched.

Uses.—*Helicigona arbustorum* formerly occupied a place in the old *Materia Medica*, and it is still used as food in some parts, but is not held in very high esteem.

Parasites and Enemies.—Though from its retiring and more nocturnal habits, it is not so liable to destruction by the usual enemies of the mollusca, yet it is far from free from attack; the thrushes and blackbirds are said to prefer this species when procurable, and its remains are sometimes found plentifully around the "thrush stones." The bank-vole and

mice are credited with destroying considerable numbers, while woodlice, leeches, and newts are all cited by reputable observers as preying upon it.

It is also liable to be infested by the several ecto- and endo-parasites which have been observed living upon the allied species.

Geological Distribution. — **PLIOCENE.** — M. Locard records the presence of *Helicigona arbustorum* in the Lower Pliocene beds of Austria and Germany.

In the British Isles, Mr. F. W. Harmer reports it from the Upper Pliocene deposits of East Anglia; in the Red Crag at Butley, East Suffolk; in the Norwich zone of the Icenian Crag at Postwick and Coltishall, East Norfolk, also at Easton-Bavent and Southwold, East Suffolk, as well as in the Weybourne zone at West and East Runton, and in the freshwater Cromer Forest-bed at West Runton.

PLEISTOCENE.—In West Sussex, it was found by Mr. J. P. Johnson in the buried river-bed on the foreshore of West Wittering.

In Wiltshire, it is reported by Mr. Blackmore from the loess and brick-earth of Fisherton, near Salisbury, and also from the drift at Milford Hill.

In Kent, it is reported from Stoneham's Pit, Crayford; from Maidstone; the brick-earths of Erith; the Ightham fissure near Wrotham; and from the pre-neolithic stratum, Dover, by the Rev. R. Ashington Bullen.

In Surrey, it was found in 1877 by Mr. T. Belt in alluvial loamy clay on the banks of the Thames at Kew; and by Mr. Meyer from the freshwater deposit disclosed by the excavations at Blackfriars.

In Essex, it is recorded by Mr. Searles V. Wood from the brick-earth at Grays, and has been found in Sam Green's Pit, Ilford, by Dr. Frank Corner. It is known from the freshwater marls of Copford and Clacton, the var. *alpestris* being recorded by Jeffreys from Copford.

In Middlesex, it is recorded from the Palaeolithic sand or gravel beds in the north-east of London by Mr. Worthington G. Smith; and at Clapton by Mr. J. E. Greenhill.

In Suffolk, Prof. Morris recorded it from freshwater marls at Stutton.

In Cambridge, Mrs. McKenny Hughes records the type form as extremely common in the Pleistocene gravels at Barnwell Abbey and Grantchester; the var. *alpestris*, though present at both stations, is especially common in the Barnwell Abbey deposit.

In Hunts., the Rev. C. E. Y. Kendall has found it rarely in the fluviatile marls at Woodston.

In Derbyshire, Mr. A. Bell reports it from the fissure deposits of Langwith.

In Lancashire, Mr. J. Wilfrid Jackson reports it from the deposits of Pleistocene age in the "Dog Holes" Cavern near Carnforth.

In Germany, it is recorded by Prof. Sandberger from North Baden as not rare in the Lower Pleistocene sands of Bruchsal. In the Lower and Middle Pleistocene it has been found in the Mosbach sands; in tufa at Dittwar near Tauberbischofsheim; in the deposits at Mauer, Heidelberg, Oos, Schierstein, Grotzingen near Durlach, and Freisenheim near Lahr; and in the Mid-Pleistocene beds of Alsace by M. Locard. The var. *alpestris* is recorded from the valley loess at Achern, Steinbach, and Heidelberg. In South Baden, the typical form has been found near Freiberg.

In Suabia, Sandberger records it at Gunzberg and Huttesheim; Dr. Weinland has found it in the loess, and in the lower beds of the Seeburger tufa in the Suabian Alb. In Upper Suabia, the var. *alpestris* has been found in sand at Essendorf.

In Saxony, it is recorded from the Lower and Middle strata at Priesa and other places near Meissen, and at Robschütz near Dresden.

In Wurtemberg, it has been found in the lower and middle Pleistocene beds at Cannstadt, Ludwigsburg, and Rappenau in the Neckar Valley; the var. *trochoidalis* being known from Cannstadt only.

In Bavaria, it is recorded by Prof. Sandberger from the Lower and Middle Pleistocene of the Danubian Valley at Passau, Regensburg, and Oellingen. Herr Clessin records it from the old alluvial beds of Pürklgut; the type and var. *alpicola* from the loess of Regensburg, and the type and vars. *trochoidalis*, *depressa*, *alpestris*, and *fuscescens* from the tufaceous deposits of the Black Laaber.

In Franconia, the typical form is recorded by Dr. von Ihering from the diluvial deposits of Streitberg and by Prof. Sandberger as found in the beds from the earliest to the latest Pleistocene periods near Würzburg.

In Thuringia, it is known from the tufaceous beds of Lower and Upper Pleistocene age at Weimar, Grafentonna, and Burgtonna; and in Nassau, is found plentifully in deposits of Lower and Middle Pleistocene time at Heigelsbachthal and Oberissigheim near Hanau, and rarely at Bad Ems.

In France, it is recorded by Locard from the Mid-Pleistocene beds of Dauphiny; and the Upper Pleistocene of the environs of Paris, and of Bas Boulonnais, and according to Sandberger in the valley loess of Lyons and the Upper Pleistocene of Montreuil, and Clichy. The type and var. *alpestris* are recorded from the gravels of Joinville-le-Pont, Seine, by Laville; in the tufa of La Celle, near Moret, Seine-et-Marne, by Tournoier; and in the base of the loess or fluvio-marine sand of Menhecourt, Somme, by Picard.

In Austria, according to Sandberger, it has been found in the valley of the Danube at Waidling and Wolkersdorf, also at Nussdorf near Vienna, the var. *alpestris* has also been found at the latter place.

In Switzerland, the var. *alpestris* is recorded by Sandberger from St. Gallen.

HOLOCENE.—In Wiltshire, the type form, vars. *fuscescens* and *cincta* found in 1909 by Mr. Harold St. George Grey in the superficial deposit in the fosse of the Great Circle at Avebury, and the var. *cincta* at a depth of six feet in the deposit of Roman age at the same place. It is recorded by the Rev. R. A. Bullen from a rain-wash in a chalk-pit at West Harnham near Salisbury.

In the Isle of Wight, it is reported by Mr. Kennard from the tufaceous lime beds at Totland's Bay and from St. Catherine's Down.

In Hampshire, Mr. Kemp records it from the Itchen Valley, from mole hills in the Anton Valley, and as rare in the tufa at Southampton Dock.

In Kent, it is recorded by Mr. Santer Kennard from the base of a tumulus of early Romano-British age at Stanley's Quarry, Ightham, mixed with bone fragments and Roman pottery from the base of a rain-wash, two to six feet in thickness, on the site of a large Roman building at Darenth; in the sandy clay alluvium at Crossness; in the early holocene bed at Cuxton, and in the deposits at Charlton, Greenhithe, and Otford. It is recorded by the Rev. R. A. Bullen from the rubble drift at Barton Court, Buckland, near Dover.

In Surrey, it is recorded by Kennard and Woodward from deposits of carbonaceous silt of Roman age, and the pre-Roman stratum of marsh clay disclosed by excavations in Tooley street, Bermondsey. The Rev. R. A. Bullen also collected specimens at depths varying from 2ft. 6in. to 4ft. in

a pre-Roman deposit in Horseshoe Pit, Colley Hill, Reigate; Mr. Kennard reports it from Walton Heath; and Mr. Woodward from Kew.

In Essex, it is recorded by Mr. B. B. Woodward from the section revealed by the excavations for the reservoirs of the East London Waterworks Company at Walthamstow; from the sandy peat of Tilbury; from the alluvium of R. Lea between Clapton and Walthamstow; by Mr. Kennard from the deposits at Chingford and Dagenham; and by Kennard and Woodward from Braintree. It has been found in alluvial shell-marl at Felstead by Mr. J. French. Miller Christy records it as very common in the late holocene black-earth and peat, but rare in the shell-marl of the Cam Valley, Chignal St. James; Kennard and Woodward record it from post-glacial beds at Witham and Canning Town; and Rev. A. J. Law from a drain-section in "the Marsh," near Shalford Vicarage; Mr. Kennard from the deposits at Harwich; and Mr. Bell reports the var. *alpestris* from the early holocene beds of Copford.

In Herts., it is recorded by Mr. J. Hopkinson from the alluvial beds disclosed by the excavations for the Gas Works at Watford; and a number of var. *alpestris* and shells closely related thereto found in Feb. 1911 in the mole-hills at Wilstone by Mr. Charles Oldham.

In Middlesex, Mr. Kennard informs me of its occurrence in the sections disclosed in New Broad Street, London Wall, and Houndsditch in London, and also at Staines and Uxbridge.

In Berkshire, it is reported by Mr. Kennard from Wallingford, and from Newbury by Mr. Alfred Bell.

In Oxford, Kennard and Warren report this species from a section through Thames alluvium, of late holocene age, about a mile east of Culham Station, Clifton-Hampden.

In West Suffolk, Mr. Alfred Bell reports its occurrence in the early holocene deposit near Chichester, and at Cissbury Camp near Worthing.

In Cambridge, it is recorded by the Rev. R. A. Bullen from Harlton, in mole-casts, and from the Romano-British deposit by Butler's Spinney.

In Hunts., Mr. A. S. Kennard reports it from the deposits at St. Ives.

In East Gloucester, it is reported by Hinton and Kennard from the "quarry tip" and from the "old soil" in King's Beeches Gravel quarry, Cleeve Hill, and from Westbury-on-Severn.

In Hereford, it has been found at Ledbury by Mr. Ballard.

In Glamorgan, it is reported from early holocene deposits at Barry Docks.

In North Lincoln, Mr. Musham reports it from a deposit at Greetwell.

In South-East Yorks., it was found by Mr. Mortimer in barrows of the Bronze age in Willie Howe plantation, Sledmere; also very fine shells in a long barrow at Hanging Grimston, and in barrows at Birdsall Brow (Rev. E. P. Blackburn, *Naturalist*, 1908, p. 419).

In Germany, Dr. R. F. Scharff reports it from the holocene of Heidelberg, Baden; Prof. Cockerell from post-glacial diluvium, Kiffis, Alsace; and Dr. Boettger from that of Frankfurt-on-the-Main.

In Bavaria, it is recorded by Herr Clessin from the alluvium of the Danube at Regensburg.

In Belgium, it has been found in the "Tourbe" at Uccle lez-Bruxelles and in the modern deposits of the valley of the Dendre.

In France, it is recorded by Baudon at a depth of five feet in the gravel beds of River Therain, Oise.

In Scandinavia, it is recorded by Odhner from the post-glacial beds of Jamtland, Sweden; and from those of Gudbrandsdalen, Norway.

In Denmark, it is found in the submarine marshes, Frihavnén near Copenhagen, and in the freshwater limestone at Stovaflyng near Oxnebjerg in Jutland.

Variation.—*Helicigona arbustorum* is apparently only a conditionally dominant species, as is shown by its inhabiting and being more or less restricted to moist places in valleys and elsewhere and the more elevated hilly or mountainous regions, extending to and bordering upon the verge of perpetual snow, under which in some alpine and extreme northern districts they are usually buried for the greater part of their existence. From this wide difference in character and altitude and the strict localization of their colonies there naturally results a remarkable differentiation in the general aspect of the shells which has led to a considerable number of names being applied to the various modifications.

The varieties of diminished or diminutive size with an elevated spire would seem to be more particularly characteristic of mountainous regions and the more northern localities, though also found in marshy districts and sporadically elsewhere, while those inhabiting the lower ground or more genial southern climes are usually of a larger and flatter type.

In substance the variation is also considerable, some shells being strong and thick, while others are of excessive tenuity and indeed little more than a mere organic film; these results are usually assumed to be the outcome of living upon a calcareous soil or upon one deficient of that substance, but though this undoubtedly has a great effect, the difference is probably often physiological and due to the efficiency in the selective action of the tissues of the individual snail.

The effect of food in influencing or modifying the colouring of the shell of this species has been frequently affirmed, the yellow varieties being observed by Mr. W. Baillie to be always more abundant and finer about plants of the meadow sweet (*Spiræa ulmaria*) and coltsfoot (*Tussilago farfara*), while amongst nettles the shells are generally darker in colour. The influence of the character of the food upon the colouring or pigmentation of the shell is strikingly shown by the fact that some immature individuals of the var. *fusca*, found by Capt. Farrer at York feeding upon wild parsnip, were conveyed to Bassenthwaite and there fed to maturity on cabbage and lettuce, but the new growth of every shell was of the typical character or referable to the var. *flavescens*, and the junction of the new growth was thus very distinctly indicated.

"Pink" shells are recorded by the late Mr. Sherriff Tye as found feeding upon coltsfoot at "Wren's Nest," Dudley, and the same variation was discovered by Mr. R. Wigglesworth at Clitheroe in Lancashire.

In the var. *flavescens* and certain other of the paler varieties the epidermis or periostracum is often noticeably duplicated or doubled, resembling in this respect some of the tropical *Bulimi*. In the present species the outer film is usually darker in colour but very deciduous and frequently only perceptibly preserved on the body-whorl.

In the thinner varieties the outer lip is not thickened and beautifully rounded as in typical shells, but is always thin and delicate with a white submarginal rib.

The species is very closely simulated in its shell characters by several Euadeniate species occupying the Pacific coast of North America, but the internal organization is of quite a different type.

VARIATIONS OF FORM OF SHELL.

Var. **trochoidalis** Roffiaen, Ann. Soc. Mal. Belg., 1868, vol. iii., p. 69, pl. 1, f. 2a, b.

Helix arbustorum var. *conoidea* Westerlund, Exp. Crit. Moll. Suède, etc., 1871, p. 42.

Helix arbustorum var. *trochiformis* Wattebled, Journ. de Conch., 1889, p. 320.

Helix feroeli Bourguignat in Servain, Bull. Soc. Mal. France, 1889, p. 370.

Helix albulana Bourguignat in Servain, op. cit., 1889, p. 388.

Helix thamnivaga Mabille, Bull. Soc. Philom. Paris, 1883.

Helix thamnophila Servain, Bull. Soc. Mal. France, 1889, p. 371.

Helix trochoidalis Servain, Bull. Soc. Mal. France, 1889, p. 378.

Helix xatarti Servain, Bull. Soc. Mal. France, 1889, p. 392 (not Farines).

SHELL of medium size, with a more elevated and conoid spire than the type, and nearly subscalariform.

Diam. 19 mill.; alt. 20 mill.

The sub-var. **conoidea** is banded and subperforate, and a larger, ruder, more elate form than the type, described as possessing subcostulate sculpture and pale yellow spots with closely confluent transverse lines.

Diam. 23-24 mill.; alt. 25-26 mill.

The sub-var. **trochiformis** is described as a rather fragile shell, of medium size and globosely conical, with a blunt apex, and spotted and flammulated with yellow. Capt. Wattebled remarks that this variety differs from var. *alpicola* by its much greater size, blunter spire, and deeper coloured but thinner shell.

The sub-var. **xatarti** of Servain is conoid in form, greenish-yellow in colour, with indistinct fleckings and a dark peripheral band. Diam. 19; alt. 18 mill.

The sub-var. **thamnivaga** has an elate spire, and a voluminous body whorl; it is also thinner, dark fawn in colour, with yellowish marblings, and a dark supra-peripheral band, as in the typical form. Diam. 20; alt. 18 mill.

The *H. thamnophila* would seem to be merely a *lapsus pennæ* or synonym for *thamnivaga*.

The sub-var. **feroeli** is described as rimate, conical in shape, with rapidly increasing whorls, and allied to but less elevated than sub-var. *thamnivaga*. It varies from yellowish to a copper colour or a greenish shade with or without marblings or band. Diam. 22 mill.; alt. 18 mill.; and an aperture 11 mill. in altitude and width. Dr. Servain cites Clessin (Exc. Moll. 1884, f. 107) as figuring this form as var. *trochoidalis*.

The sub-var. **albulana** is described as quite trochoid in form, but normal in colouration, and as 20 mill. in altitude, and 24 mill. in diameter; and the aperture as 12 mill. in width and 11 mill. in altitude.

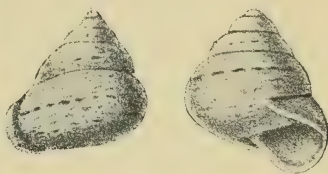


FIG. 482.—*H. arbustorum* var. *trochoidalis* Roffiaen.

Andeer, Grisons, Switzerland (after Roffiaen).

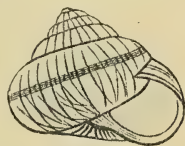


FIG. 483.—*Helix feroeli* = *H. arbustorum* v. *trochoidalis* Clessin (after Clessin).

ENGLAND AND WALES.

WILTS. S.—Devizes, C. D. Heginbotham.

SUSSEX E.—Pells, Lewes, J. H. A. Jenner.

NORTHAMPTON—Sub-var. *conoidea*, Brackley, A. Loydell. Weston-Favell, Lionel E. Adams.

Pembroke—In lane near Hoyle's Mouth, Tenby, A. G. Stubbs.

Cardigan—Llynant Valley near Borth, Aug. 1905! A. H. Jowett-Murray.

Lincoln S.—Mere, Feb. 1902! Rev. W. Wright Mason.

Lincoln N.—North Ormsby and Wyham, Oct. 1900! C. S. Carter. Howsham, 1901! Rev. E. A. Woodruffe-Peacock. Bardney, Oct. 1906! J. F. Musham.

Notts.—Sub-var. *conoidea*, Darlton, B. Sturges Dodd.

Derby—Repton! E. Candler. Clifton near Ashbourne, C. E. Wright. On road to Winnats, Castleton, July 1901! J. W. Jackson. Sub-var. *feroeli*, Buxton (Servain, l.c.).

Cheshire—Holmes Chapel, Rev. H. G. Barnacle. Whaley Bridge, Sept. 1895, C. Oldham. Northwich, June 1903! J. W. Jackson.

Lancashire S.—Clitheroe, July 1886! J. A. Hargreaves. Sub-var. *feroeli* near Manchester (Servain, l.c.).

York S.E.—Sub-var. *conoidea*, Wressle, G. Roberts; and Fulford, near York, Rev. W. C. Hey. Givendale, Pocklington, Oct. 1889! W. J. Farrer.

York N.E.—Cayton Bay, Sept. 1909! W. E. Brady. Castle Howard, and city walls, York, R. M. Christy.

York Mid W.—Ingleton, Sept. 1888! E. Collier. Kildwick, 1904! F. Booth.

Durham—Durham, April 1885! Baker Hudson; and Croft Spa near Darlington, Sept. 1890! Charles Oldham.

SCOTLAND.

Dumbarton—Near Shandon, Gareloch, July 1887! A. Shaw.

Cantire—Arlin Gillan, north of West Loch Tarbert, April 1886! T. Scott.

CONTINENTAL DISTRIBUTION.

Germany—Var. *trochoidalis* described by Herr Clessin as plentiful in woods by the Danube at Dillingen in Bavaria, also found at Dinkelscherben, Suabia, and at Harburg, near Hamburg. Sub-var. *thamnivaga* in rejectamenta of the River Ill, near Mulhouse, Alsace, and sub-var. *feroeli* near König See, Bavaria (Servain, l.c.).

Holland—Heerenveen, Friesland, 1893! G. K. Gude.

France—St. Jean-de-Maurienne, Savoy (Servain, l.c.). Hauteville near Lyons (Locard, Mal. Lyonn., 1877, p. 26). Sub-var. *trochiformis*, rare in the wood of Vielverge, on right of road from Soissons to the fields on left bank of Saône, Côte d'Or (Wattebled, l.c.). Sub-var. *conoidea*, Chamounix, Haute Savoie! F. H. Sikes. Sub-var. *thamnivaga*, about Plombières, Vosges. Sub-var. *zartarti* Servain, Prats-de-Mollo, Pyrénées-Orientales. Sub-var. *feroeli*, Grande-Chartreuse, Isère, and in association with sub-var. *albulana*, Arcis-sur-Aube, Aube (Servain, l.c.).

Switzerland—Ander, Grisons (Roffiaen, l.c.). Sub-var. *feroeli*, near Kussnacht, Canton Schwyz (Servain, l.c.).

Austro-Hungary—Var. *trochoidalis* and sub-var. *albulana* on banks of the Danube, at Musdorf near Vienna, Austria (Servain, l.c.).

Norway—Var. *trochoidalis*, Gröto, Nordland (Esmark, J. of C., 1886, p. 108).

Sweden—Sub-var. *conoidea*, Fogelsang near Lund (Westerlund, l.c.). Sub-var. *feroeli* reported by Dr. Servain from specimens supplied by Dr. Mörch.

Denmark—Humlebaek, Zealand; Isle of Bornholm; also Horsens, and Lemvig in Jutland (Steenberg, Landsnegle Danmarks, 1911, p. 104). Sub-vars. *thamnivaga* and *feroeli* recorded from Denmark by Dr. Servain, on the authority of specimens sent by Dr. Mörch of Copenhagen.

Var. *planospira* Gras.

Helix planospira Gras, Moll. d'Isère, 1840, p. 36, pl. iii., f. 11.

Helix arbustorum var. *repellini* Moquin-Tandon, Hist. Moll. France, 1855, p. 124.

Helix knitteli Bourg. in Servain, Bull. Soc. Mal. France, 1889, p. 400.

Helix vibrayana Servain, Bull. Soc. Mal. France, 1889, p. 391.

Helix arbustorum var. *depressa* Westerlund, Moll. terr., etc., 1871, p. 42.

Helix arbustorum var. *maynardi* Caziot, Feuille Jeunes Nat., 1910, p. 184.

The var. *planospira* is flat, striate, and umbilicated, of a yellowish colour with white marblings and a brown supra-peripheral band. Diam. 23-24; alt. 12 mill.

Dr. Servain regards M. Gras' figure of *H. planospira* as exactly representing the var. *repellini* of Charpentier.



FIG. 484.

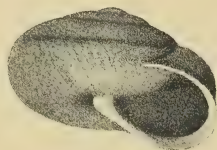


FIG. 485.

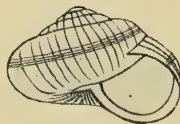


FIG. 486.

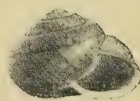


FIG. 487.

FIG. 484.—*Helicigona arbustorum* sub-var. *depressa*, Heidelberg, Baden, Mr. G. K. Gude.

FIG. 485.—*Helicigona arbustorum* var. *planospira* Gras, Lautaret, Isère (after Gras).

FIG. 486.—*Helicigona arbustorum* sub-var. *depressa* Clessin (after Clessin).

FIG. 487.—*Helicigona arbustorum* var. *maynardi* Caziot, Mt. Vaghieros, Alpes Maritimes.

The sub-var. *depressa* Westerlund is large, depressed, thin and perforate, with the colouring of the typical form. Diam. 25; alt. 18 mill.

The sub-var. *knitteli* is described as shell depressed, the last whorl noticeably descending, giving to the penultimate whorl a greater prominence, of a beautiful thin and translucent ochreous tint, but changing to copper-red with the usual marblings and supra-peripheral band. Diam. 25; alt. 19 mill.

The sub-var. *repellini* is described by Moquin-Tandon as much flatter, thin, and somewhat translucent. Dr. Servain gives the dimensions of typical shells as diam. 26 and alt. 17 mill., and states that it is the var. *depressa* of Clessin (Exc. Moll. Fauna, 1884, f. 106). It has been named var. *lateumbilicata* by Abbe Dupuy.

The sub-var. *maynardi* is described as depressed in shape, of a pellucid, very dark maroon, with a brown supra-peripheral band. Diam. 17-18; alt. 12-14 mill. It is considered by its author to be nearest the var. *alpicola*.

The sub-var. *vibrayana* is described as possessing a depressed shell, with an obtusely rounded spire, and showing a constriction near the columellar margin, followed by a blunt gibbosity. Aperture horizontally broad. Diam. 24; alt. 17 mill. Aperture 13 mill. broad, and 10 mill. in altitude.

Kent E.—Sub-var. *depressa*, Dover, 1887, R. Standen.

York S.E.—Sub-var. *depressa*, Wressle, J. Beanland.

ENGLAND.

Antrim—Sub-var. *depressa*, Murlough Bay, July 1904, J. W. Jackson.

IRELAND.

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *vibrayana*, banks of River Ill, Mulhouse, Alsace, and the vicinity of König-See, Bavaria (Servain, l.c.). Sub-var. *depressa*, Heidelberg, Baden, G. K. Gude; Silesia (Westerlund, Prodr. Faun. Moll., 1878, p. 90).

France—Var. *planospira* is described by Gras as rare, at the foot of rocks on the Alps on the road from Lautaret, Isère. Sub-var. *depressa* is recorded as very rare at de la Mouche, Rhône, by M. Locard. Sub-var. *repellini* is recorded by Charpentier and Dr. Servain from the Hautes Alpes at Queyras, and especially at Abries, also from Bourg d'Oisans, Embrun, the Col de la Traversette by Mt. Viso, and from between Grave and Briançon, as well as from the Alps of Dauphiny generally. Sub-var. *vibrayana*, margins of R. Aube at Dienville and Arcis-sur-Aube (Servain, l.c.); Angers, Maine-et-Loire (L. Germain). Sub-var. *maynardi*, according to Comm. Caziot, lives only on rhododendron stems near the plain of Sadour at an altitude of about 8,000 feet on the eastern slope of Mt. Vaglieros, Alpes Maritimes, where for eight months in the year they are buried beneath the snow.

Italy—Sub-var. *repellini* is recorded by Prof. Lessona at an altitude of 7,500 feet from Mt. Viso in the upper valley of the River Po, Piedmont, but it had been previously observed there by Stabile, though at a lower elevation.

Switzerland—Sub-var. *depressa*, Bad Pfaffers, Sept. 1867, E. von Martens; and Wallenstadt, St. Gall, 1886, R. Standen. Sub-var. *repellini*, Stanstadt, Unterwalden (Servain, l.c.).

Austro-Hungary—Sub-vars. *depressa* and *knitteli*, Salzburg. Sub-var. *repellini*, Carinthia (Westl., Prodr. Faun. Moll., 1878, p. 89).

Scandinavia—Sub-var. *depressa* occurs sporadically in Skane in the extreme south of Sweden, as well as at Skien near Christiania, Norway.

Var. *musdorfensis* Servain.

Helix musdorfensis Servain, Bull. Soc. Mal. France, 1889, p. 393.

Helix illusana Servain, op. cit., 1889, p. 395.

Helix nazarina Bourguignat in Servain, op. cit., 1889, p. 395.

SHELL subdepressed, but somewhat subconoid above; body whorl ample, and angulated at the periphery; of a brownish-yellow colour without dark peripheral band, but with some paler marblings. Diam. 21 mill.; alt. 16½ mill.

The sub-var. *nazarina* is of similar size, but more distinctly angulated, of a beautiful straw yellow, without marbling, but with a distinct maroon band. Diam. 20; alt. 16 mill.

The sub-var. *illusana* is about the same size, but slightly more depressed, and not distinctly angulated; it is pale yellowish in colour, with clearer markings, and has a peripheral maroon band. Diam. 20; alt. 15 mill.

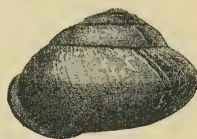


FIG. 488.—*H. arbustorum* var. *musdorfensis* Serv., Reichenberg, Bohemia, Mr. G. K. Gude.

CONTINENTAL DISTRIBUTION.

Germany—The sub-vars. *nazarina* and *illusana* have been found on the banks of the River Ill, near Mulhouse, Alsace (Servain, op. cit.).

France—The sub-var. *nazarina* is from the alluvium of the Loire, above St. Nazaire, Loire Inférieure (Servain, op. cit.).

Austro-Hungary—The var. *musdorfensis* is from the banks of the Danube at Musdorf near Vienna, Austria (Servain, op. cit.). A slightly more depressed form is from Reichenberg, Bohemia! G. K. Gude.

VARIATIONS IN SCULPTURE OF SHELL.

Var. **rudis** Muhl., Rossm., Icon., 1837, pts. v. and vi., f. 297e.

- Helix arbustorum* var. *depressa* Férussac, Hist. Moll., 1822, pl. 27a, f. 8, 9.
Helix xatartii Farines, Desc. Coq. Pyr. Orient., 1834, p. 6, ff. 7-9.
Helix arbustorum var. *stentzi* Rossm., Icon., 1837, vol. i., pl. 5, f. 78.
Helix canigonica Fagot, Esp. Pyr. Gr. *arbustorum*, 1879, p. 4.
Helix fagoti Bourguignat in Locard, Prodr. Mal. Fran., 1882, pp. 60 and 306.
Helix arbustorum var. *sendtneri* Clessin, Regensb. Corresp.-Blatt., 1882, p. 10.
Helix camprodunica Kobelt, Rossm. Icon., 1883, p. 37, f. 108.
Helix xatartii var. *camprodunica* Kobelt, Icon., vol. i., 1884, p. 37, f. 108.
Helix trachia Bourguignat in Servain, Bull. Soc. Mal. France, 1889, vol. vi., p. 405.
Helix arbustorum var. *alpestris* f. *costulata* Kobelt, Icon., 1884, vol. i., p. 38, f. 109.

The var. **rudis** is depressed, strong-shelled, and rugosely plicate, with a perceptible umbilicus. The original figure shows a shell 18 mill. diam., and 14 mill. alt.

The animal is described by Dr. Steenberg as of a yellowish-brown, tinged with reddish, and to possess a somewhat shorter flagellum than the typical form. (See Monog., pl. 35, f. 5).

According to Westerlund, it is only found in the higher alps and is not known below about 3,500 feet.

The sub-var. **sendtneri** is depressed, dark brown, and smaller than the type form, with an open umbilicus and prominent rib-like striae as in var. *rudis*.

It is the *Helix aberrata* of Ziegler according to Clessin.



FIG. 489.



FIG. 490.

FIG. 489.—*Helicigona arbustorum* sub-var. *sendtneri* Clessin.

FIG. 490.—*Helicigona arbustorum* sub-var. *stentzi* Rossm. (after Clessin).

The sub-var. **stentzi** is a medium-sized and rugosely-striate shell with a rather open umbilicus and a subconoid spire.

The sub-var. **trachia** differs by its less prominent costulations, less elevated but more convex spire, and the great development of the body whorl. The shell is 24 mill. in diameter and 17 in altitude.

By some oversight Dr. Servain cites Clessin's figure of the var. *rudis* (Mollusk. Oesterr.-Ungarns, p. 178, f. 83) as perfectly representing his two species *Helix trachia* and *Helix stentzi*.

The sub-var. **xatartii** is depressed in form, and moderately umbilicated, solid, strongly striate, and even subcostulate, yellowish in colour, tinged with green or by a burnt and brownish shade, with a few yellow fleckings on the body whorl. Diam. 19-20; alt. 13-14 mill. This form is also the var. *canigonicensis* of Fagot and Moquin-Tandon.

The sub-var. **costulata** is larger and more depressed than the typical *alpicola*, but with bluntly-ribbed sculpture as in the var. *xatartii*. Diam. 19; alt. 15 mill.

The sub-var. **camprodunica** is subdepressed, strongly striate, of a yellowish-brown tinged with green, with a peripheral zone, and partially open umbilicus. Diam. 19 mill.; alt. 12 mill.

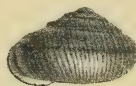
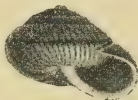


FIG. 491.

FIG. 492.

FIG. 491.—*Helix arbustorum* sub-var. *depressa* Férussac (after Férussac).

FIG. 492.—*Helix arbustorum* sub-var. *camprodunica* Kobelt, Camprodon, Catalonia.

The sub-var. **canigonica** is described as depressed, imperforate, somewhat thin and irregularly subcostulate, of a greenish-horny colour, with a transparent and partially effaced supra-peripheral brown band, and a thin and slightly reflected lip. Diam. 18-20; alt. 7-10 mill.

The sub-var. **depressa** of Férussac is, according to Dr. Servain, identical with the sub-var. *camprodunica* of Kobelt.

SCOTLAND.

Dumfries—Bell Crag wood, Moffat, Miss Hele.

Perth N.—Pitroddie Den, F. Smith.

Forfar—Craig Farm, Montrose ! W. Duncan.

CONTINENTAL DISTRIBUTION.

Germany—Hanau, Nassau, E. von Martens. Sub-var. *sendtneri*, summit of the Osser, Bavaria (Clessin, l.c.).

France—Slopes of the Brevent, Chamounix, Haute Savoie, Sept. 1876 ! ; sub-var. *camprodonica*, on the mountains of Mont-Louis, Pyrénées Orientales (Servain, l.c.) ; sub-vars. *xatartii* Farines, and *canonica* Fagot, Pyrénées Orientales.

Austro-Hungary—Salzburg and Untersberg, E. von Martens. It is especially characteristic of the Tyrol, and recorded from the Dolomites by Gredler ; from Arlberg by E. von Martens ; while Mr. E. Collier has specimens from Valfondo ; and Mr. G. K. Gude from Mont Messules. Sub-vars. *stentzi* and *trachia* are found near the mountain tops of the Tyrol (Servain, l.c.). Sub-var. *xatartii*, Choralpi in Carinthia, E. von Martens.

Switzerland—Wengern Alp, Canton Berne, E. von Martens.

Italy—Sub-var. *costulata*, Val Tonale, Lombardy, at an altitude of 8,300 feet (Kobelt, l.c.). Sub-vars. *stentzi* and *trachia* are found on the mountain summits of the Alpine region of Lombardy, the latter notably from Agordo near Brescia (Servain, l.c.).

Spain—Sub-var. *camprodonica*, Camprodon near Gerona ! J. H. Ponsonby.

Norway—Christiania, G. O. Sars. Fredriksvaern and Dovre at an altitude of 1,000 metres, B. Esmark.

Denmark—Learsøen nr. Lygten, Jutland, and at Rudesdal, Zealand (Westl., l.c.).

VARIATIONS IN SUBSTANCE OF SHELL.

Var. *calcareea* Högberg, K. Sv. Vet. Ak. Handl., 1841.

Helix arbustorum var. *creticola* Mörch, Syn. Moll. Dan., 1864.

The var. *calcareea* is described as possessing a thick, solid, and calcareous shell, fuscous-chestnut in colour, with yellow fleckings; interior obscurely purplish. Diam. 22-25 mill. ; alt. 16-21 mill.

The sub-var. *creticola* is described as having the shell large, very solid and ponderous. Diam. 27 mill. The weight of a typical specimen in the Museum of the Copenhagen University is 15 grains.



FIG. 493.—*Helicigona arbustorum* var. *creticola* Mörch, Island of Møen, Denmark (Coll. Copenhagen University).

ENGLAND.

York S.E.—Specimens have been found by Mr. J. F. Musham at Barlby near Selby, weighing 13 grains.

CONTINENTAL DISTRIBUTION.

Sweden—Var. *calcareea*, almost everywhere in the Isle of Gothland and adjacent island of Karloarne; also at Hallbros in Westerheide, and in Thorsburg (Westerlund, Syn. Moll. Sver., 1871, p. 43).

Denmark—Sub-var. *creticola*, in a limestone quarry, Klintholm, Isle of Møen (Steenberg, Landsnegle Danmarks, 1912, p. 104).

Var. *picea* Rossmässler, Iconog., 1837, Heft v., vi., p. 5, 6, f. 297 d.

Helix arbustorum var. *conica-nigra* Férussac, Hist. Moll., 1822, pl. 27a, f. 10.

Helix arbustorum var. *fusca* Moq.-Tand., Hist. Moll., 1855, vol. ii., p. 124.

Helix aethiops Bielz, Verh. Mitth. Siebenb. Ver., 1860, p. 221.

Helix arbustorum var. *septentrionalis* Clessin, Mal. Bl., 1879, vol. i., pp. 14, 15.

Helix arbustorum var. *fragilis* Esmark, Norges Moll., 1880, p. 99.

Helix arbustorum v. *fragoti* Bourg. in Locard, Prodr. Mal. France, 1882, pp. 60 & 306.

Helix arbustorum vars. *fragilis* and *fulva* Watterbled, Journ. de Conch., 1889, p. 319.

Helix arbustorum var. *gottlandica* Westerlund, Nachr. Deutsch. Mal. Ges., 1894.

Helix arbustorum var. *membranacea* Steenberg, Landsnegle Danmarks, 1912, p. 104.

Helix arbustorum var. *zittmanni* Zawadzky MSS.

The var. **picea** is described as very thin, uniformly olive-brown, without paler fleckings. Rossmässler's figure shows a diameter and altitude of 19 mill.

This variety is typically the colour of pitch, but varies in substance from extreme tenuity and translucence to a certain degree of opacity, determined by the calcareous or siliceous soils upon which it lives.

According to Dr. Servain, the *H. arbustorum* var. *conica-nigra* of Férussac is identical with var. *picea*.

The sub-var. **æthiops** is depressly globose, thin, of an uniformly olivaceous or fuscous black, and narrowly umbilicated. Diam. $14\frac{1}{2}$ –21 mill.; alt. $10\frac{1}{2}$ – $14\frac{1}{2}$ mill. (See Monog., pl. xxxv., f. 17).

The sub-var. **fusca** is very thin and of a nearly uniform semitransparent brown, and according to Dr. Jeffreys, may or may not possess the darker band. (See Monog., pl. xxxv., f. 9).

The sub-var. **fagoti** is thin, fragile, and transparent, with rounded striæ, and of an uniform olivaceous tint without bands or marblings, differing from *æthiops* in its smaller size and more globose form. Diam. 15 mill.; alt. 10 mill.

The sub-var. **fragilis** Esmark is small, very thin, and glossy, of a dark brown, with a few paler striæ and specks, aperture with a thin white rib. Diam. 15–17 mill.; alt. 11–14 mill.

The sub-var. **fragilis** Wattebled is of medium size, thin, and fragile, of a semi-transparent brown in tint, with yellow fleckings, and with or without the suprapерipheral band.

The sub-var. **fulva** is of a clear fawn with a few pale brown marks or flecks.

The sub-var. **membranacea** is very thin and transparent, but with colour and markings as in the typical form. The var. *sylvestris*, judging by specimens from the Bülow collection, in the possession of Mr. E. Collier, is identical.

The sub-var. **wittmanni** is described as very thin, strongly striate, uniformly olivaceous in colour, and with or without the peripheral band. Diam. 20; alt. 13 mill.

The sub-var. **septentrionalis** is thin and pellucid, of a rufous-brown colour, with a dark supra-peripheral band, and pale specklings. Diam. 19; alt. 14–15 mill.

The sub-var. **gotlandica** is a large, thin, pellucid, and banded form. Diam. 25 mill.; alt. 17 mill.

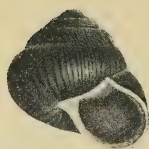


FIG. 494.—*H. arbustorum* var. *picea* Rossm. (after Rossmässler).

ENGLAND AND WALES.

Cornwall W.—Sub-var. *fusca*, Scilly Isles, W. H. Hatcher.

Sussex E.—Sub-var. *fusca*, Ecclesbourne Glen, Hastings, G. H. Rowe.

Surrey—Sub-var. *fragilis*, Mortlake, J. E. Cooper.

Notts.—Sub-var. *fragilis* Esmark, Southwell, June 1884 ! Capt. Becher.

Brecon—Sub-var. *fusca*, Clydach, 1909 ! F. H. Sikes.

Merioneth—Sub-var. *fusca*, Dolgelly, Aug. 1901, H. R. Wakefield.

Lancashire S.—Sub-var. *fusca*, Barlow Moor wood, July 1889, R. Standen. Clitheroe and Manchester, I. Stephenson.

Lancashire Mid—Sub-v. *fusca*, waste ground by R. Lune, Lancaster, J. D. Dean.

York S.W.—Sub-var. *fusca*, Oulton and Wentbridge, J. Wilcock.

York N.W.—Sub-var. *fusca*, Coverdale, R. C. Chaytor.

York S.E.—Sub-var. *fusca*, feeding on wild parsnip, Fulford, York, W. J. Farrer. Barlby near Selby, weighing 5 grains, June 1911 ! J. F. Musham. Wressle and banks of River Derwent, T. Petch. Sub-var. *fragilis* Wattebled, Fulford road, York, 1896 ! H. Sowden.

Westmorland—Sub-var. *fusca*, Kirkby Lonsdale, J. Davy Dean.

Cumberland—Sub-var. *fusca*, Stanwix, Grinsdale, Wetheral, near Spa Well, and Carlisle, Mrs. Longstaff.

SCOTLAND.

Dumfries—Sub-var. *fusca*, feeding on garlie leaves, Bell Crag wood, Moffat, July 1882, Miss Hele.

Lanark—Sub-var. *fusca*, Summerston, 1887 ! Alex. Shaw.

Perth S.—Sub-var. *fusca*, on gneissic rock, 2,200 ft. alt., Craigmore, Aug. 1888 !

A. Somerville. Ben More, Rev. W. C. Hey.

Sutherland W.—Sub-var. *fusca*, Assynt, 1882 ! W. Baillie.

Sutherland E.—Sub-var. *fusca*, on a cold exposed rock, 800 feet above the sea, Loch Brora; and in a well wooded shady spot by Golspie Burn, Sep. 1883 ! W. Baillie.

Orkneys—Sub-v. *fusca*, amongst heather, Howe, Harray, July 1906, C. E. Wright.

Shetlands—Sub-var. *fusca*, Lunna ! Rev. A. M. Norman. Sub-var. *fragilis* Wattebled, Brough of Clickimin, Lerwick ! G. K. Gude,

IRELAND.

Antrim—Sub-v. *membranacea*, Plantation Port, Kenbane, July 1904 ! R. Standen.
 Cavan—Sub-var. *fusca*, Urney Graveyard near Cavan, July 1911, R. Welch.

CONTINENTAL DISTRIBUTION.

Germany—Var. *picea* recorded from Rhenish Prussia at Hanau by E. v. Martens, and from Speyer and Homburg, Sept. 1911 ! F. H. Sikes. Var. *picea* and sub-var. *fusca*, Triberg, Baden, Sept. 1911 ! F. H. Sikes. Sub-var. *sylvestris*, Steinach, Baden ! E. Collier ; sub-var. *fusca*, St. Blasien, labelled var. *picea* in the Bülow collection ! E. Collier ; sub-var. *fragilis*, Wattebled, Bad Serneux, labelled var. *schlechtneri* Clessin in the Bülow collection ; and an extraordinarily thin variety from Silesia is in the collection of Mr. J. H. Ponsonby.

France—Var. *picea* is recorded by Cailliaud from Cordemais, Loire Inférieure. Sub-var. *fagoti* is found on the lofty pastures of Costa Bona, near the source of the River Tech, Pyrénées Orientales (Servain, l.c.). Sub-var. *fusca*, recorded from Mont Dore, Auvergne, by Fischer, and from Upper Vosges, by Puton.

Switzerland—Dr. Hartmann records from Seealp, Appenzell, as var. *subalpina* a pale horn-coloured and transparent shell.

Italy—Abbé Stabile records the var. *picea* from Piedmont at an altitude of more than 5,000 feet, near Gressoney ; from Ordpa at 1,500 feet ; and from the slopes of Monte Rosa. Prof. Lessona records the var. *dorici* Paulucci from an altitude of 8,500 feet on the Col. d'Ollen, and on Mont Barone at over 6,000 feet.

Austro-Hungary—Var. *picea*, Carniola and Bohemia. Sub-var. *æthiops* is found on the elevated pastures of Transylvania, attaining to nearly 7,000 feet.

Norway—Var. *picea*, Trondfjeld, Osterholm, and Korsvold, near Christiania (Westerlund, l.c.). Sub-var. *septentrionalis*, Skien near Christiania (Esmark, l.c.). Sub-var. *gotlandica* is found at Rosendal in the Isle of Gothland. Sub-var. *fragilis* Esmk., Eidsvold, Modum and Skedsmo near Christiania ; it has also been found at Kongsvold on the Dovre at near 3,000 feet altitude ; on the Trondfjeld, 3,000 to 5,000 feet above the sea, and at Tromsø (Miss Esmark, *Nyt Mag. Nat.*, 1880, p. 99).

Sweden—Var. *picea*, common at Trossnaes, the Nors district, and throughout Warmland, according to Fristedt and Westerlund. Sub-var. *septentrionalis* is common on the slag-heaps overgrown with nettles near Galtström and at Astränderma, Medelpad, and extends southwards to Skane (Westerlund, op. cit.).

Denmark—Var. *picea*, Fur, Jutland ; Little Klint, Moen ; and on Lolland ; also sub-var. *membranacea*, Vordingborg, Zealand (Steenberg, 1912, p. 104).

Iceland—Sub-var. *fusca*, Seydisfjord, Sept. 1884 ! W. Eagle Clarke ; Nordfjord, 1912 ! F. H. Sikes.

Russia—Sub-var. *wittmanni* is recorded from Volhynia (Servain, l.c.). Sub-var. *septentrionalis* is found in the western and southern provinces of Finland on the limestone hilly region and on the low-lying shores of the Gulfs of Bothnia and Finland, but absent from the intervening ground (Luther, op. cit.).

Var. *baylei* Moquin-Tandon, *Hist. Moll. Fr.*, 1855, vol. ii., p. 124.

Helix arbustorum var. *albinos* Dum. & Mort., *Mal. Savoie*, 1857, p. 78.

The var. *baylei* is smaller, more conoid, extremely thin, and transparent, and of an uniform greenish-yellow colour, without calcareous fleckings.

The sub-var. *albinos* is of an uniform pale straw-yellow, without calcareous fleckings or variegations, and with var. *baylei* s.s. bears a great resemblance to *Helix hortensis* var. *lutea* (see Monogr., pl. xxxiv., f. 18).

ENGLAND AND WALES.

York Mid W.—A pale yellow form (the var. *albinos* of Dum. & Mort.), in a hedgerow near Bishopthorpe, York ! H. Sowden.

SCOTLAND.

Sutherland E.—On a cold exposed rock, 800 feet above the sea, amongst nettles and foxglove near Loch Brora, Sept. 1883 ! W. Baillie.

Sutherland W.—East of Kyle of Tongue, July, 1883 ! W. Baillie.

CONTINENTAL DISTRIBUTION.

Germany—Reichenhall, Bavaria, as v. *lutescens* in the Bülow collection ! E. Collier.

France—The var. *baylei* recorded from Mont Dore by Moquin-Tandon. Sub-var. *albinos* D. & M. is cited for many localities in Savoy and Haute Savoie.

Switzerland—Dr. Hartmann cites a form of this variety from a considerable altitude on the Seealp, Appenzell ; the sub-vars. *subalpina* and *alpestris* are also found living there, but at a lower elevation.

VARIATIONS IN SIZE OF SHELL.

Var. **major** L. Pfeiffer, Mon. Hel. Viv., 1848, vol. i., p. 340.

Helix arbustorum var. *excelsa* Clessin, Mal. Blatt., N.F., 1886, vol. viii., p. 166.

Helix arbustorum var. *magna* Kuster f. von Martens.

Helix arbustorum var. *grandis* Parreyss.

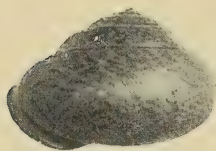


FIG. 495.

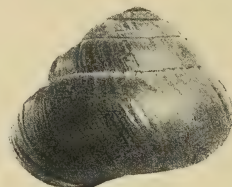


FIG. 496.

FIG. 495.—*Helix arbustorum* var. *major* Pfeiffer, Carpathian Mountains, Wallachia, G. K. Gude.

FIG. 496.—*Helix arbustorum* sub-var. *excelsa* Clessin, Buda-Pesth, F. H. Sikes.

SHELL larger. Diam. 30 mill. ; alt. 20 mill.

Dr. Servain erroneously refers to the var. *jetschini* of Ulicny the shells figured by Martini and Chemnitz, Monog. *Helix* (pl. 57, figs. 4, 5), which are more properly regarded as the var. *major*.

It is also, according to Dr. E. von Martens, the var. *magna* of Kuster, and judging by specimens in the Bülow collection, the var. *grandis* Parreyss is identical with the sub-var. *excelsa* Clessin.

Dr. Jeffreys' var. *major* is described as shell larger, spire more depressed, 25 mill. in diam., and $17\frac{1}{2}$ mill. in alt., and as not very uncommon. Prof. E. von Martens gives the dimensions of the variety as diam. maj. 29 mill., diam. min. 26 mill., and alt. 20 mill., and describes it as "albida, fusco-conspersa, fascia rufa, lata." Mr. L. E. Adams assigns an alt. of 20 mill. and a diam. of 27-30 mill. for the variety.

Mr. Rimmer ascribes no special dimensions to this variety, which he describes as "shell larger, spire considerably depressed."

The sub-var. *excelsa* is very large and strong, with bright though normal colouration and altitude of spire. Diam. 30 mill. ; alt. 21 mill.

ENGLAND AND WALES.

Kent E.—Var. *major* Jeffr., Dover, July 1898, C. E. Wright.

Oxford—Var. *major* Jeffr., near Oxford, 1881 ! Rev. S. Spencer Pearce.

Northampton—Var. *major* Jeffr., Thorpe, rare, July 1882, A. W. Nichols. Oundle, July 1905, C. E. Wright.

Derby—Var. *major* Jeffr., Matlock, 1885 ! H. E. Craven.

York S.E.—Var. *major* Jeffr., Fulford gravel pits, Sept. 1879, Rev. W. C. Hey. Newsholme, July 1886 ! J. Beanland.

York S.W.—Var. *major* Jeffr., Oulton and Wentbridge, 1883, J. Wilcock.

York Mid W.—Var. *major* Jeffr., Knaresborough, 1866, J. Blackburn.

York N.E.—V. *major* Jeffr., Castle Holmes, Scarborough, July 1881, C. Ashford.

CONTINENTAL DISTRIBUTION.

Germany—Var. *major* Jeffr., Wachwitz and Georgenthal, Saxony, F. H. Sikes. Heidelberg, Baden, 1887 ! Wilfred Bendall. Passau, Bavaria, Mrs. Fitzgerald.

France—Var. *major* Jeffr., Grande Chartreuse, Isère, 1882 ! Rev. S. S. Pearce ; and is recorded from St. Maur-les-Fossés, Seine, by M. Pascal. Recorded by Capt. Wattebled as common on the banks of the Loire from Chay, Côte d'Or, to Montbarrey, Jura.

Switzerland—Var. *major* Jeffr., Frutigen, Canton Berne, Aug. 1876 !

Austro-Hungary—Var. *major* Pfr., on the Monchberg, Salzburg (Pfeiffer, l.c.). Grossraming, Upper Austria (Clessin, l.c.). Var. *major* Jeffr., Gmunden and Salzkammergut, Upper Austria ; and Buda-Pesth, Hungary, 1882 ! Mrs. Fitzgerald. Var. *major* Amstellia, Vienna, Austria ; and sub-var. *excelsa*, Buda-Pesth, Hungary ! F. H. Sikes. Sub-var. *magna*, Carniola, Dr. E. von Martens. Sub-var. *grandis*, Parreyss, Grossraming, Upper Austria ! E. Collier.

Roumania—Var. *major* Pfr., Carpathian Mountains, Wallachia ! G. K. Gude. Sub-var. *excelsa*, Poana Stanei, at an altitude of about 6,000 feet (Clessin, op. cit.).

Russia—Var. *major* Pfr., Crimea, E. von Martens.

Var. *alpicola* Féruſſac, Tabl. Syst., 1819, p. 34, pl. 27, f. 7.

- Helix arbustorum* var. *alpestris* Zglr., Rossm., Icon., 1835, p. 57, pl. 5, f. 297b.
Helix arbustorum var. *alpicola* Charp., Moll. Suisse, 1837, p. 6.
Helix arbustorum vars. *alpinula* and *subalpina* Hartm., Gast. Schweiz, 1844, p. 57, etc.
Helix arbustorum var. *minima* Pir., Mon. Hel. Viv., 1848, vol. i., p. 340.
Helix alpestris Dum. & Mort., Mal. Savoie, 1857, p. 80.
Helix arbustorum var. *alpina* Tate, Brit. Moll., 1866, p. 137, pl. vii., f. 62a.
Helix elaphra Mabille, Bull. Soc. Philom. Paris, 1883.
Helix arbustorum var. *minor* Steenberg, Landsnegle Danmarks, 1912, p. 104.

The var. ***alpicola*** is identical with the var. *alpestris* of Rossm., and is markedly smaller in size than the typical form, with a more elevated spire; usually the shell is yellowish in colour, solid and opaque, with a darker supra-peripheral band. Diam. 14; alt. 13 mill. (see Monogr., pl. xxxiv., f. 6).

The var. *alpicola*, though occasionally found under other quite different but equally unfavourable conditions, is essentially a stunted alpine form, frequenting the elevated mountain pastures of Europe, on felspathic, talcous or calcareous rocks, quite to the limit of perpetual snow, and in montane districts are often buried beneath the snow for the greater part of the year.

The sub-vars. *alpinula* and *elaphra* are apparently identical, differing from var. *alpicola* s.s. in being often somewhat smaller in size, thinner in substance and nearly pellucid, and sometimes marbled or speckled, but are here restricted to the marbled or speckled forms.

The sub-var. *subalpina* of Hartmann & Scholtz is intermediate between the type and var. *alpicola* in size and character, with a solid shell, which tends occasionally to be somewhat transparent.

The sub-var. *minor* is slightly larger and more depressed in form than typical var. *alpicola*. Diam. 15; alt. 13½ mill.

The sub-var. *minima* is less elevated than var. *alpicola*. Diam. 14; alt. 10 mill.

ENGLAND AND WALES.

Somerset N.—Leigh Woods! Miss F. M. Hele.

Kent E.—Folkestone, Rev. A. M. Norman.

Herts.—Numerous on the marshes by the side of the R. Lea, Hoddesdon, and all of the same form and size, J. Pickering (J. G. Jeffreys, Brit. Conch., 1862). Broxbourne, A. Reynell. Grounds of Ware Priory, 1877, Dr. J. Gwyn Jeffreys.

Oxon.—Cropredy (D. Pidgeon, Q. J. C., 1875, p. 56).

Bucks.—Colnbrook, June 1906! F. H. Sikes.

Bedford—Tottenhoe Mead, 1888, J. Saunders.

Northampton—Kettering & Twywell, July 1896. Barford, Jan. 1893, C. E. Wright.

Stafford—Grindon, Dovedale, E. D. Bostock.

Lincoln S.—Grantham, R. Worsdale.

Lincoln N.—On banks of Witham, 1882, J. T. Lightwood. Hubbard's Hill, Louth, and Wyham, 1900, also Pelham's Pillar Wood and Caistor, August 1902, C. S. Carter.

Notts.—Near Darlton, B. Sturges Dodd.

Derby—Monksdale, May, 1888! T. Hey. Matlock, 1885! H. E. Craven. Monsal Dale, Rev. H. Milnes. Buxton, 1887, J. H. Ponsonby. Chapel-en-le-Frith, and associated with sub-var. *alpinula*, Miller's Dale, August 1892! C. Oldham.

Lancashire S.—Simonstone, 1889! R. Wigglesworth. Whalley, Sept. 1885! E. Collier.

York S.E.—Settrington, Sept. 1877! H. Pollard. Kirkham Abbey, Aug. 1891, Lionel E. Adams.

York N.E.—Hambleton Hills, Sept. 1881! R. M. Christy.

York S.W.—Wentbridge and Oulton, 1883, J. Wilcock. Goole, August 1877! W. Nelson.

York Mid W.—Knaresborough, 1866, J. Blackburn. Malham, June 1883! W. West. Barnoldswick, June 1909, F. Booth. Small bog by canal, Skipton, July 1884! W. Whitwell. Ingleton, August 1877! W. Denison Roebuck.

York N.W.—Worton, August 1877! H. Crowther. Coverdale, 1887, R. C. Chaytor. Satron and near Ivelet Bridge, July 1884! W. Denison Roebuck.

Westmorland and Lake Lancashire—Troutbeck, F. H. Sikes. Shores of Lake Windermere, 1887, A. Holland.

Cumberland—Keswick (J. Murray, Trans. Carlisle Nat. Hist. Soc., 1909).

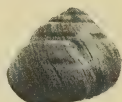


FIG. 497.—*H. arbustorum* var. *alpicola* Férr., Hoddesdon, Herts.

SCOTLAND.

Renfrew—Shiellhill Glen, August 1886 ! T. Scott.

Lanark—Near Uddingston, June 1889 ! and near Summerston, A. Shaw.

Haddington—East shore, North Berwick ! Rev. Dr. McMurtrie.

Edinburgh—Banks of Water of Leith, near Balerno, May 1882 ! W. Evans. Dr. Leach remarks that the specimens found at Cannon Mills, Edinburgh, have a tendency to become turreted, and notes one example over an inch in altitude.

Linlithgow—Carribber Glen, Feb. 1898 ! and Hopetown, near South Queensferry, May 1882 ! W. Evans.

Perth E.—Banks of Craigeour Burn, Moulin, June 1875 ! and at Pitlochry, H. Coates. Glen Tilt, May 1885, Dr. Buchanan White. Hill of Tulloch, near Blair Athol and Barnhill, J. Dawson.

Perth Mid.—Ben Laoigh, at an altitude of 3,000 feet, July 1891, J. C. Melvill.

Sutherland W.—Strathy, October 1886 ! Rev. J. E. Somerville.

CONTINENTAL DISTRIBUTION.

The var. *alpicola* is constant in its diminutive size and comparatively loftier spire and is found most characteristically at great altitudes on the granite or limestone mountain regions, attaining the regions of perpetual snow on the alpine pastures, Mr. Collier having found it at an altitude of 7,500 feet above Arolo.

Germany—Recorded from the Mittenwald, Upper Bavaria ; from Schneeberg, Saxony ; and from Silesia ; but according to Schmidt not yet found in N. Germany.

France—Recorded from mountains of Dauphny, Jura and Auvergne, and from Mont Cenis ; and Dr. Fischer records it from the zone of *H. glacialis* at an altitude of 6,000–8,000 feet at Cauterets, Hautes Pyrénées.

Italy—Recorded from the Piedmontese, Lombardian, and Venetian Alps at elevations of about 6,000 feet.

Austro-Hungary—Recorded from Carniola, and from the Dolomites and other places in the Tyrol ; and by Pfeiffer from the Gamsgrube, Carinthia, at an altitude of 8,600 feet on Mt. Glockner, Upper Austria. Specimens labelled “var. *jetschini*, Moravia,” in the Bülow collection ! E. Collier.

Switzerland—Reported from the summit of the Gemmi Pass, Leukerbad, and Arolo, in Valais ; Andermatt, Brieg, Hospenthal and Wesen in Uri ; at an altitude of 7,000 feet in Glarus ; in Neuchâtel on the Saut de Doub, and with a relatively lofty spire on the Chasseron and Chasseral at altitudes of 5,000 feet ; Iseltwald, Meiringen, and Wengern in Berne ; and Bex in Canton Vaud. From the Grisons, Am Stein records the sub-var. *subalpina* ; a var. *montana* from above the region of trees on the Frugmatt at an altitude of 6,300 feet ; and the var. *alpicola* is known from St. Moritz and elsewhere, specimens 13 mill. in diameter being recorded from Davos by Dr. Kobelt. In Canton Glarus, v. *alpicola* is found at a height of 7,000 ft.

Scandinavia—Recorded as occurring sporadically throughout the peninsula ; in Norway at Groto and Lofoten in Nordland, and Gudbrandsdalen in Trondhjem ; and in Sweden at Qvickjock, Norbotten.

VARIATIONS IN COLOUR OF SHELL.

Var. *albina* Charpentier.

Helix arbustorum c. albinos Charpentier, Moll. Suisse, 1837, p. 6, pl. 1, f. 2.

Helix arbustorum c. albinos Moquin-Tandon, Hist. Moll., 1855, p. 124.

Helix arbustorum var. *albida* Rimmer, L. & F. Shells of Brit. Isles, 1880, p. 121.

SHELL with a bluish-white ground, with pure white calcareous fleckings. The illustrative woodcut given by Charpentier shows a pale shell, with slightly darker fleckings (see Monogr., pl. xxxiv., f. 11).

Moquin-Tandon describes this variety as whitish and without markings.

Though this shell is apparently a true albino, the animal itself is sometimes very deeply pigmented.

ENGLAND AND WALES.

Kent E.—Folkestone, 1883, Mrs. Fitzgerald.

Northampton—Rockingham Park, Sept. 1898, C. E. Wright.

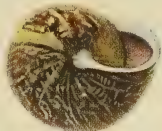
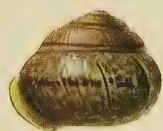
Lincoln N.—Hubbard's Valley, Louth, 1899, C. S. Carter. Howsham, May 1901 ; and Kettleby Beck, April 1904, Rev. E. A. W. Peacock. Mere, Feb. 1902, Rev. W. Wright Mason. Bardney, March 1910 ! J. F. Musham.

Notts.—Southwell (Dyson, Manchester Shells, 1850, p. 28). Colwick, 1893, B. Sturges Dodd.

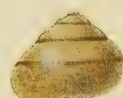
Derby—Castleton (Dyson, op. cit.). Great Longton, Miss Fairbrass.

York Mid W.—Settle, 1864 ! T. Jones. Gargrave, 1882, J. Whitwham. Near Barnoldswick, June 1909, F. Booth.

HELICIGONA ARBUSTORUM (L.).



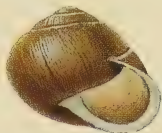
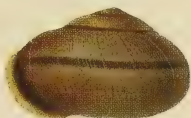
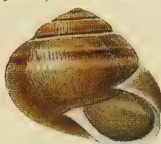
1—3. *Helicigona arbustorum* (L.).
Castleford, Yorkshire.



4. *H. arbustorum* v. *cincta* Taylor.
Jura, G. K. Gude.

5. *H. arbustorum* v. *rudis* Mhf.
Mt. Messules, Tyrol, G. K. Gude.

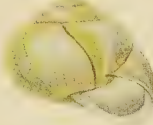
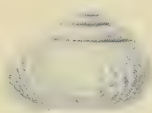
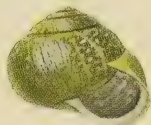
6. *H. arbustorum* v. *alpicola* Fér.
Gemmi, Switzerland.



7. *H. arb.* s.v. *hypnicola* Serv.
Bishopthorpe, York, H. Sowden.

8. *H. arbustorum* s.v. *jetschini* Ul.
Moravia, G. K. Gude.

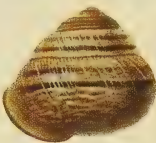
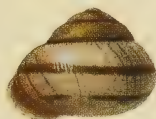
9. *H. arbustorum* s.v. *fusca* Moq.
Assynt, W. Baillie.



10. *H. arb.* v. *virescens* Taylor.
Brora, W. Baillie.

11. *H. arbustorum* v. *albina* Ch.
Bardney, J. F. Musham.

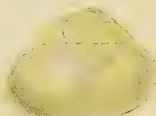
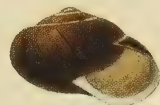
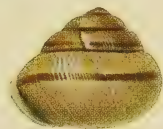
12. *H. arbustorum* v. *flavescens* Fér.
Winster, Rev. H. Milnes.



13. *H. arb.* s.v. *bifasciata* Kew.
Selby, J. F. Musham.

14. *H. arb.* s.v. *luteozonata* Taylor.
Matlock, H. E. Craven.

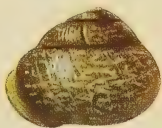
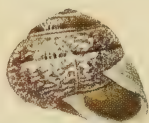
15. *H. arb.* s.v. *bifasciata* Kew.
Aysgarth, F. W. Wilson.



16. *H. arb.* v. *canigonensis* Boub.
York, J. E. Morland.

17. *H. arbustorum* s.v. *aethiops* Bielz.
Transylvania.

18. *H. arbustorum* v. *baylei* Moq.
York, H. Sowden.



19. *H. arbustorum* v. *rufescens* Moq.
Bardney, J. F. Musham.

20. *H. arb.* v. *luteofasciata* D. & M.
Tintern Abbey, C. T. Musson.

21. *H. arb.* v. *fuscescens* D. & M.
Castleford, Yorkshire.

CONTINENTAL DISTRIBUTION.

Germany—Recorded from Neuwied, Rhenish Prussia, by Dr. J. D. W. Hartmann.

Switzerland—Rare on the mountains and plains about Bex, Vallorbe, and Valley of Lac de Joux, Canton Vaud (Charpentier, op. cit.). Neuchâtel ! F. H. Sikes. Grindelwald, Thun, and Kienthal, Canton Berne ; Trient in Valais ; Bex in Vaud ; and Lucerne, Hugh Watson.

One specimen found at Malans, Grisons, by Major Am Stein, is recorded by Dr. Hartmann.

Var. flavescens Férussac, Tabl. Syst., 1821, p. 34, p. 27, f. 8.

Helix arbustorum var. *morbosa-albina* Rossm., Icon., 1835, p. 37.

Helix arbustorum var. *lutescens* Dum. & Mort., Mal. Savoie, 1857, p. 78.

Helix arbustorum var. *icterina* Roff., Ann. Soc. Mal. Belg., 1868, p. 70.

Helix arbustorum var. *scalvina* Adami, Moll. terr. Brescia, 1875, p. 47.

Helix arbustorum var. *oelandica* Westerlund, Nachr. Deutsch. Mal. Ges., 1894.

Helix arbustorum var. *pallida* Westerlund, Faun. Eur. Moll. Extr., ii., p. 89, 1878.

SHELL usually yellowish, with more or less numerous opaque paler specklings, interior of shell milk-white.

When tenanted by the living animal, the dark body is perceptible through the thinner parts of the shell, to which it imparts a greenish tinge.

This variety, though rarer than the type, is as widely dispersed and ranges with it.

It is the var. *morbosa-albina* of Rossmässler according to Dr. Westerlund, and the var. *scalvina* of Adami according to Herr Clessin.

The var. **flavescens** s.s. is of an almost uniform opaque pale straw-yellow, due to the close aggregation of calcareous speckling, without the dark supra-peripheral band (see Monogr., pl. xxxiv., f. 12).

The var. **morbosa-albina** is pale yellow, yellowish-grey in parts, without or with a faintly perceptible peripheral band.

The sub-var. **lutescens** is described as pale transparent yellow, with opaque straw-coloured marblings, and without band. Inside, the shell is hyaline white, variegated with milk-white. Dumont and Mortillet are of the opinion that their variety *lutescens* represents Charpentier's var. *albinos*.

The sub-var. **icterina** is described as pale subtransparent yellow in colour, sprinkled with greyish, and without band, apex pale greyish.

The sub-var. **pallida** Westerlund is described as thin, pale horn colour (seldom pale yellowish-white), transparent, with small linear yellow flecks, often arranged transversely ; growth lines sometimes white.

The sub-var. **oelandica** has a partially open umbilicus, is pale yellow in colour, densely maculate ; interior milk-white. Aperture strongly arcuate, with a thin rib. Diam. 20 ; alt. 16 mill.

Derby—Sub-var. *icterina*, Miller's Dale, July 1890 ! C. Oldham.

ENGLAND.

SCOTLAND.

Sutherland E.—Sub-var. *icterina*. Golspie Burn, in well wooded and shady places, feeding chiefly on Allium and Coltsfoot (W. Baillie, June 1883).

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *icterina*, Triberg, Baden, Sept. 1911 ! F. H. Sikes.

France—Sub-var. *lutescens* is recorded by Dumont and Mortillet from Savoy and Upper Savoy as found up to an altitude of 6,000 feet, and from an altitude of 3,000 feet at Grande Chartreuse, Isère.

Italy—Sub-var. *scalvina* is recorded by Adami.

Austro-Hungary—Sub-var. *morbosa-albina*, Brenner Pass, Tyrol ! E. Collier.

Switzerland—Sub-var. *icterina*, recorded from Iseltwald and Meiringen, Canton Berne ; Sarnen in Unterwalden ; Wesen in Uri ; and the gorge of the Tamina, in the Grisons (Roffiæn, op. cit.).

Sweden—Sub-var. *morbosa-albina* is found in Botanical Gardens, Lund, and on tree-trunks, about limestone blocks, and on plants, especially the hop, in various places about Wisby, and in pastures about Klint, in the Island of Gothland ; as well as on the Islet of Carlsoarne ; and sub-var. *oelandica*, Oeland (Westerlund, l.c.).

Denmark—Sub-var. *pallida* Westerlund and Muller common about Copenhagen in Zealand, also in Funen, Langeland, and East Jutland ; sub-var. *morbosa-albina*, scarce on Zealand, Funen, and Bornholm (Steenberg, l.c.).

Var. virescens Taylor, var. nov.

The var. *virescens* is of a translucent greenish tint, with yellow shadings and fleckings (see Monogr., pl. xxxiv., f. 10).

Turton's Manual, 1831, p. 35, enumerates a greenish-yellow variety.

A mutation *virescens* is given by Schmidt without description.

ENGLAND.

York N.E.—Var. *virescens*, a lovely yellow shell, mottled with green, at Scarborough, Aug. 1888, J. R. le B. Tomlin.

SCOTLAND.

Sutherland E.—Var. *virescens*, in shady, well wooded places, feeding chiefly on *Allium* and Coltsfoot at Golspie Burn, June 1883 ! W. Baillie.

CONTINENTAL DISTRIBUTION.

Germany—The mut. *virescens* is described by Schmidt as plentiful in S. Germany.

Norway—Miss Esmark records an unicolorous green-grey shell, Renneskog near Christiania, and a brown one with a greenish tinge from Floifjeld in Arctic Norway.

VARIATIONS IN MARKINGS OF SHELL.

Var. fuscescens Dum. & Mort., Mal. Savoie, 1857, p. 79.

Helix arbustorum var. *marmorata* Roff., Ann. Mal. Soc. Belg., 1868, p. 70.

Helix arbustorum var. *efasciata* Mörch, Syn. Moll. Dan., 1861.

The var. *fuscescens* is described as possessing a brown or reddish ground colour, but destitute of the dark supra-peripheral band (see Monogr., pl. xxxiv., f. 21).

The sub-var. *marmorata* is also bandless, variously marbled with yellow and brownish, and with a brownish apex.

The sub-var. *efasciata* is described by Steenberg as resembling the typical form of the species, but destitute of the supra-peripheral band.

This is also my var. *marmorata*, that name being superseded by *fuscescens*, the name bestowed long before by Dumont & Mortillet.

GEOGRAPHICAL DISTRIBUTION.

This variety is as widely distributed as the typical form, and frequently found with it, but not so numerously.

Var. rufescens Moquin-Tandon, Hist. Moll. France, 1855, p. 123.

Helix arbustorum vars. *rufescens*, *boisseria*, *poiretia* and *draparnaudia* Moq.-Tand.

Hist. Moll. France, 1855, p. 123.

Helix dravica Servain, Bull. Soc. Mal. France, 1889, p. 383.

The var. *rufescens* has a clear reddish ground colour with white frecklings with or without perceptible bands (see Monogr., pl. xxxiv., f. 19).

The sub-var. *poiretia* is distinguished by yellow and white frecklings on a brown ground colour.

The sub-var. *draparnaudia* is greenish-brown with yellow frecklings.

The sub-var. *thomasia* has white frecklings on a grey ground.

The sub-var. *boisseria* has a violet ground colour with white specklings.

The sub-var. *dravica* is described as of a violaceous colour, with a band of the same colour, and whitish marblings, and would seem to be identical in these respects with the sub-var. *boisseria*.

Dr. Turton in his Manual differentiates a variety without bands and marbled with white spots, but without citing localities.

ENGLAND.

Suffolk E.—Sub-var. *poiretia*, Blaxhall ! G. T. Rope.

York N.E.—Sub-var. *poiretia*, Saltburn Woods, Oct. 1886 ! Baker Hudson.

Lancashire S.—Sub-var. *poiretia*, Simonstone, Aug. 1891 ! R. Wigglesworth.

SCOTLAND.

Lanark—Sub-var. *poiretia*, near Summerston ! Alex. Shaw.

CONTINENTAL DISTRIBUTION.

France—The var. *rufescens* and sub-var. *thomasia* are recorded by Pascal from St. Maur-les-Fossés, Seine; and Orsay, Longjumeau, etc., Seine-et-Oise; and the sub-var. *poiretia* from La Beaume, Haute Loire, by Moquin-Tandon.

Switzerland—Sub-var. *poiretia*, Maloja Pass, Grisons, 1886 ! Rev. S. S. Pearce.

Austro-Hungary—Sub-var. *dravica* in rejectamenta of the ditches of the Fort of Esseg on the Drave, Slavonia (Servain, l.c.).

VARIATION IN COLOUR OF LIP OF SHELL.

Var. *luctuosa* Slavik.*Helix arbustorum* var. *luctuosa* Slavik, Moll. Bohm., 1869, p. 95.*Helix themita* Mabille, Bull. Soc. Philom., 1883, p. 5.*Helix striatula* Schrank, Fauna, vol. iii., p. 269, no. 3178.*Helix arbustorum* var. *roseolabiata* Schlessch, Nautilus, Oct. 1908, p. 55.

The var. *luctuosa* is of deep dark brown or dun colour, with indistinct marblings and black-brown band; aperture and lip brownish.

This appears to be the var. *roseolabiata* of Roberts, and is probably also the var. *nigrescens* of Locard.

The sub-var. *themita* is of a sooty colour, and further distinguished by the upper and lower margins of the aperture being almost parallel. Diam. 22 mill.; alt. 12–15 mill. No allusion is made to the colour of the lip, but this form is probably correctly allocated here.

The sub-var. *striatula* is distinguished by its warm brown lip, and according to Hartmann's illustrative figure is a shell of otherwise normal colouring.

ENGLAND.

Dorset—A very black and strong shell, Marnhull! E. W. Swanton.

York S.W.—Sub-var. *roseolabiata*, Lofthouse near Wakefield, G. Roberts.

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *nigrescens*, Steinach, Baden! E. Collier.

Holland—Sub-var. *themita*, environs of Utrecht (Servain, l.c.).

France—Sub-var. *themita*, environs of Bourg, Ain (Servain, l.c.).

Switzerland—Some hundreds of examples of var. *striatula* were found by Herr von Schrank at St. Gallen associated with specimens of *Helix pomatia*, which also possessed the same peculiarity of violet-red or liver-brown lips.

Austro-Hungary—Var. *luctuosa*, Nucnitz near Randnitz, Bohemia (Slavik, l.c.).

Denmark—Var. *roseo-labiata* is described by Schlessch from Ringsted, Zealand.

VARIATIONS IN BANDING OF SHELL.

This group is subdivided with a view of demonstrating and emphasizing the existence of atavic peculiarities amongst those specimens inhabiting mountainous regions, and also occurring sporadically in a few lowland areas.

SECTION A.—The Atavic forms in which the character of the banding of the typical *Campylea* is more or less retained, the dark peripheral band being placed upon and within a broader, paler, and more or less calcified zone.

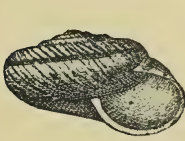
Var. *styriaca* Frauenfeld.*Campylea styriaca* Frauenfeld, Verh. Zool. Bot. Ges. Wien, 1868, xviii., p. 149.*Helix arbustorum* var. *corneoliformis* Lessona, Moll. Piem., 1879, p. 49, pl. iv., f. 11.*Helix arbustorum* var. *jetschini* Ulicny, Beitr. Moll. Mahren, 1887, p. 161.

FIG. 498.



FIG. 499.

FIG. 498.—*Helix arbustorum* var. *styriaca* Frauenfeld (after Clessin).

FIG. 499.—*Helix arbustorum* var. *corneoliformis* Lessona (after Lessona).

The var. *styriaca* is described as very depressed, roughly striate and moderately umbilicated, of a dark fuscous-horny colour, with indistinct pale yellowish flammules and striae, and a dark supra-peripheral band upon a broader pale zone. Diam. 22½–25½ mill.; alt. 12½ mill. It is figured by Kobelt (Rossm., Icon., f. 988). M. Schepmann describes the genital organs and “dart” as identical with those of *H. arbustorum*, but the radula as a “little different.”

The sub-var. *jetschini* is more depressed than the typical form, very thin and translucent, and the umbilicus frequently closed, of a deep brown colour with a few fleckings, and encircled near the periphery by a broad paler zone, upon which the usual dark supra-peripheral band is placed. This form in which the animal is entirely black is apparently quite identical with the var. *moravica* of Prof. Stossich (see Monogr., pl. xxxiv., f. 8).

The sub-var. *corneoliformis* is depressed, openly umbilicated, of a yellowish colour, with pale flammules, and a dark supra-peripheral band. Though not mentioned in the description, the figure shows a pale peripheral zone, and this is also inferred from the statement of its affinity with the var. *styriaca*.

CONTINENTAL DISTRIBUTION.

Italy—The sub-var. *corneoliformis* is recorded by Prof. Lessona from Mount Viso, Piedmont, at an elevation of 7,500 feet.

Austro-Hungary—Var. *styriaca*, Styria, and according to Dr. Servain at Salzburg. The sub-var. *jetschini* is recorded by Uliený from the Gevatterloch at Teplitz near Weisskirchen, Moravia, amongst a rank growth of nettles and *Impatiens noli-me-tangere*. Dr. Servain records it from around Salzburg, and large specimens from the detritus of the Danube at Musdorf, near Vienna, but he seems not to possess a proper appreciation of the characteristics of this form.

Var. *canigonensis* Boubée.

Helix canigonensis Boubée, Bull. Hist. Nat. Moll., 1833, no. 37, p. 36 (not of Fagot or Moq.).

Helix hypnicola Mabille, Bull. Soc. Philom., 1882, p. 7.

"SHELL globose, somewhat fragile, striate, with a greenish epidermis, and destitute of any system of colouration, and only ornate with a brown band faintly marked on the keel which is almost round." Diam. 19 mill.; alt. 14 mill. (see Monogr., pl. xxxiv., f. 16).

This variety shows also the somewhat calcified paler peripheral zone, upon which the dark band is placed, and is therefore placed in the present section.

This variety, of which the original description of Boubée is given, has been variously viewed by conchologists; the usual opinion is to regard it as practically identical with the var. *xatartii*, as is done by Moquin-Tandon, a view with which I am unable to agree.

The sub-var. *hypnicola* is described as moderately thick and opaque, as of a yellow or reddish colour, without marblings, and usually with a narrow peripheral maroon band. Diam. 17-18 mill.; alt. 13-14 mill. (see Monogr., pl. xxxiv., f. 4).

ENGLAND.

Wilts. S.—Devizes, C. D. Heginbotham.

Hants. S.—Ditcham Wood, Sept. 1906, Rev. W. A. Shaw.

Kent E.—A colony at Ewell near Dover, Sept. 1891, L. E. Adams.

Northampton—Reported from Harrington, July 1906, and Maidwell Dale, May 1906, by Rev. W. A. Shaw; and from Rushton, Aug. 1899, by Mr. C. E. Wright.

Lincoln S.—Canwick, March 1910 ! J. F. Musham.

Lincoln N.—Cadney, Feb. 1900, Rev. E. A. Woodruffe-Peacock.

Lancashire S.—Clitheroe, July 1889, R. Wigglesworth.

York Mid W.—Malham, June 1883 ! W. West. Bishopthorpe, York, 1882 ! occasionally found with the type, J. E. Morland; a browner form, the sub-var. *hypnicola*, has been found in the same locality by Mr. Sowden. Barnoldswick, June 1909, F. Booth.

CONTINENTAL DISTRIBUTION.

France—In the Pyrénées Orientales it is abundant at the base of the Pic du Canigon, while Dupuy states that it lives abundantly at Costa Bona, some kilometres above Preste near the source of the Tech. Sub-var. *hypnicola*, summit of Mt. Enis, Savoy (Servain, l.c.).

Italy—Vallone delle Forchioline, above Castel Delfino, at an altitude of about 9,000 feet (Lessona, l.c.).

Austro-Hungary—Sub-var. *hypnicola*, Königstein, Transylvania ! E. Collier.

Switzerland—Sub-var. *hypnicola*, the valley of the Rosenlauri glacier, Canton Berne (Servain, l.c.). Dr. Hartmann cites this form from Straubenzell, St. Gall.

Scandinavia—Recorded from Lapland by J. Stephenson, Sci. Goss., 1894, p. 166.

Iceland—Sub-var. *hypnicola*, rather abundant in the north of the island amongst moss and by water courses (Servain, l.c.).

SECTION B.—Those varieties in which there are recognized differences in the pigmentation and in the number of the bands.

Var. luteofasciata Dum. & Mort., Moll. Savoie, 1857, p. 78.

SHELL pale transparent yellow, with opaque straw coloured marblings, with a hardly apparent pale band (see Monogr., pl. xxxiv., f. 20).

The sub-var. *luteozonata* Taylor sub-var. nov. differs from var. *luteofasciata* in having a ground colour as in the typical form (see Monogr., pl. xxxiv., f. 14).

Usually the pale band occupies the position of the dark supraprimeral band, but Hartmann figures a shell in which the pale band occupies the position of the fifth band in the pentatenuate formula.

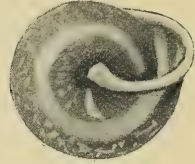


FIG. 500.—*Helix arbustorum* var. *luteozonata*, St. Gallenkappel (after Hartmann).

ENGLAND AND WALES.

Kent E.—Sub-var. *luteozonata*, Ewell near Dover, Sept. 1891 ! L. E. Adams.

Kent W.—Var. *luteofasciata*, St. Mary Cray ! S. C. Cockerell.

Northampton—Sub-var. *luteozonata*, Barford, and Oundle, C. E. Wright.

Gloucester E.—Sub-var. *luteozonata*, Birdlip, Oct. 1910, C. E. Wright.

Monmouth—Var. *luteofasciata*, Tintern Abbey ! C. T. Musson.

Derby—Sub-var. *luteozonata*, Winstler, May 1889 ! Rev. H. Milnes. Deepdale near Buxton, Dec. 1899 ! L. E. Adams. Miller's Dale, July 1890 ! C. Oldham.

York S.E.—Sub-var. *luteozonata*, Kirkham Abbey, L. E. Adams.

IRELAND.

Antrim—Sub-var. *luteozonata*, Murlough Bay, also Carr's Glen and Crow Glen, Belfast, R. Welch.

CONTINENTAL DISTRIBUTION.

Switzerland—A specimen of sub-var. *luteozonata* is figured by Dr. Hartmann from St. Gallenkappel with the pale band occupying approximately the position of the fifth band in the pentatenuate formula.

Var. fasciata Locard, Ann. Agr. Lyons, 1879.

Helix arbustorum var. *bifasciata* Kew, Naturalist, Sept. 1903, p. 341 and fig.

Helix arbustorum var. nov. *trifasciata* Taylor.

Helix arbustorum var. nov. *tetrafasciata* Taylor.

Helix arbustorum var. nov. *quinquefasciata* Taylor.

The var. *fasciata* is described as of a brown or reddish colour, with one or more darker spiral bands.

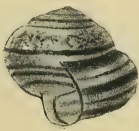


FIG. 501.



FIG. 502.

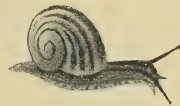


FIG. 503.

FIG. 501.—*Helix arbustorum* var. *tetrafasciata* Taylor, Schännis, Switzerland (after Hartmann).

FIG. 502.—*Helix arbustorum* var. *bifasciata* Kew, Werdenberg, Switzerland (after Hartmann).

FIG. 503.—*Helix arbustorum* var. *trifasciata* Taylor, Steinach, Switzerland (after Hartmann).

Herr Clessin has recorded five specimens in his collection, which although regarding as possible hybrids with *Helix nemoralis*, he refers to this species. They are of a rich yellow colour, and possess the pentatenuate banding, the formulæ being 12345, (12)345, (12)305, 12345^s, and 12345^s5^s. Dr. Hartmann has also incidentally alluded to a five-banded variety.

The sub-var. *bifasciata* is described as "resembling the type, but having two bands, one normally placed, the other midway between it and the suture" (see Monogr., pl. xxxiv., ff. 13 and 15).

All bifasciate shells, whatever the position of the banding, are, however, included under this term until the range of band variation of the species is better known, and a formula devised to indicate their relative positions; and this applies equally to the vars. *trifasciata*, *tetrafasciata*, and *quinquefasciata*.

The sub-var. **trifasciata** may be described as possessing three dark spiral bands.

The sub-var. **tetrafasciata** has four dark revolving bands.

The sub-var. **quinquefasciata** has five dark revolving bands.

ENGLAND.

Dorset—A small variety, with three brown bands round the last whorl (sub-var. *trifasciata*) is recorded from Stoke Wake Hill, Houghton Wood, by Mr. J. C. Mansel-Pleydell (Moll. Dorset, 1899, p. 12).

Northampton—A bifasciate shell with bands placed approximately as in bands 3 and 4 of the pentatæniæ formula, found at Kettering by Mr. C. E. Wright.

York N.W.—Sub-var. *bifasciata* Kew, on roadside near the stepping-stones, Aysgarth, May 1903 ! F. W. Wilson (see Monogr., pl. xxxiv., f. 15).

York S.E.—One bifasciate specimen with bands occupying approximately the positions of bands 3 and 4 of the pentatæniæ formula, found by Mr. J. F. Musham at Barlby Bank near Selby ! (see Monogr., pl. xxxiv., f. 13).

Durham—A specimen from Barnard Castle showing a fine but distinct additional band, occupying approximately the position of band 2 of the pentatæniæ formula ! is in the Edinburgh Museum (Rimmer Coll.).

CONTINENTAL DISTRIBUTION.

Switzerland—Dr. Hartmann figures an immature specimen with a pale yellow ground and three dark red-brown bands on the upper side (var. *trifasciata*) from Steinach, Canton St. Gall.

A two-banded example is figured by the same author with bands placed as in the var. *bifasciata* Kew, from Gams, near Werdenberg, Canton St. Gall.

A four-banded shell (var. *tetrafasciata*) is also figured from Schännis, St. Gall; it is not full grown, and is described as thin shelled, with its bands arranged as in *Helix hortensis*, etc., but the line between the fourth and fifth band is stated as indicated too strongly by the artist.

Var. **cincta** Taylor.

Helix arbustorum v. *pallida* Taylor, Journ. Conch., 1881, vol. iii., p. 250 (not Westld.).

SHELL of a yellowish ground tint, with a distinct and dark supra-peripheral band (see Monogr., pl. xxxiv., f. 4).

The name *pallida* bestowed by me upon this variety thirty-three years ago, was subsequently ascertained to have been used by Dr. Westerlund to indicate a form of the var. *flavescens*, so that a new name, **cincta**, is proposed to distinguish the present form.

The var. *cincta* though widely distributed throughout the range of the species is not an abundant form.

MONSTROSITIES.

Monstr. **sinistrorsum** Férussac.

Helix arbustorum monstr. *a. sinistrorsa* Férussac, Tabl. Syst., p. 34, pl. 39, f. 3.

Helix arbustorum var. *d. contraria* Charpentier, Moll. Suisse, 1837, p. 6.

SHELL reversed in coiling.

ENGLAND.

Middlesex—A fossil specimen was found in the holocene deposits of the Colne Valley, near Uxbridge, by Mr. J. E. Cooper.

Northampton—Maidwell Dale, Oct. 1905, Rev. W. A. Shaw. Denford, Aug. 1910, C. E. Wright.

ENGLAND.

Derby—A specimen, the var. *flavescens* in colouring, on nettles, at roadside, Ashwood Dale, near Buxton, Aug. 1887 ! C. Oldham.

CONTINENTAL DISTRIBUTION.

France—Recorded by Dr. Grateloup for the north of France.

Austro-Hungary—Found by Herr Tschapeck in the meadows by the River Salza near Mittendorf, Styria.

Switzerland—*H. arbustorum* var. *contraria*. The example figured by Férussac was found above Gryon, Vaud (Charpentier, op. cit.); and Dr. Hartmann figures two specimens found by Herr Scheuchzer at Chur in the Grisons.

Denmark—A specimen recorded by Dr. Möreh as found in the neighbourhood of the Rosenborg Bastion, Copenhagen.

Monstr. scalare Férussac.

Helix arbustorum monstr. *scalare* Férussac, Tabl. Syst., 1820, p. 34, pl. xxix, ff. 1, 2.
Helix turgidula Wood, Index Test. Suppl., 1828, pl. 7, f. 6.

SHELL with the whorls more or less dislocated.

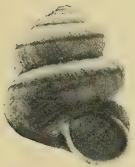


FIG. 504.

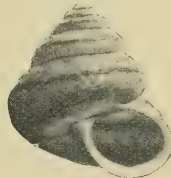
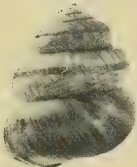


FIG. 505.



FIG. 504.—*H. arbustorum* m. *scalare* Fér., Whaley Bridge, Cheshire, Mr. H. Allan, junr.
 FIG. 505.—*H. arbustorum* sub-var. *subscalare*, Castleton, Derby, Mr. R. Standen.

ENGLAND.

Derby—A subscalarid shell, the Winyats, near Castleton ! R. Standen.
Cheshire—Whaley Bridge, May 1912 ! H. Allan, junr.

CONTINENTAL DISTRIBUTION.

Holland—Heerenveen, Friesland ! G. K. Gude.

Norway—A cornucopiate specimen at Modum near Christiania, Miss B. Esmark.

Geographical Distribution.—*Helicigona arbustorum* is chiefly a north European species, reaching to the furthest limits of north-western Europe, but has extended into Spain in the south-west, and as far as the Crimea in the south-east; as a subdominant species it has been expelled from the most favourable districts, and now inhabits the lofty mountain-summits or the marshy tracts of low-lying lands, and is comparatively scarce in the intervening areas. Though probably most frequently found on calcareous ground, it is not confined to any special geological formation, but is found almost indifferently on nearly every variety of ground, the influence of the surroundings being frequently reflected in the character of the shell.

It has been recorded, apparently erroneously, from Sicily by Aradas and Maggiore, and Mr. Lowe is incorrectly said to have quoted it as Madeiran; it has also been by some error recorded from Tripoli by Dr. Stecker; from North America by Dr. P. P. Carpenter and others; and by Dr. Kuster from Verreaux, New South Wales.

H. arbustorum is known to exist in Germany, Holland, Belgium, France, Switzerland, Spain, Denmark, Scandinavia, Poland, Austro-Hungary, Italy, Roumania, and several of the provinces of Russia. It is also perhaps the commonest *Helix* in Iceland, where it occurs of excessive tenuity.



FIG. 506.—Geographical Distribution of *Helicigona arbustorum*.

▨ Probable Range.

■ Recorded Distribution.

BRITISH ISLES.

Though probably inhabiting all the comital and vice-comital areas into which the British Isles have been divided, yet in England and Wales it has not been actually recorded from West Norfolk, South Essex, or Montgomery. The record for the Isle of Man is on the authority of Prof. Forbes, who in his *Malacologia Monensis*, published in 1838, described this species as not common in damp shady places, but its occurrence there has never been confirmed.

In Scotland, it is not yet recorded from the Hebrides or Easternness.

In Ireland, although according to present knowledge chiefly restricted to the north, it probably exists in more or less sparsely scattered colonies throughout the country. It is actually known to inhabit Antrim, Armagh, Cavan, Donegal, Fermanagh, Londonderry, Leitrim, Sligo, and Westmeath, and has been recorded from Co. Down by Mr. Thompson, from Dublin by Capt. Brown, from Killarney, Co. Kerry, by the Rev. Thomas Hincks, while specimens existed in the collection of the late Dr. W. H. Evans, collected by himself near Limerick.

GERMANY.

Diffused throughout Central and Northern Europe, and has been reported from Alsace, Anhalt, Baden, Bavaria, Brandenburg, Bremen, Brunswick, Cassel, Darmstadt, Franconia, Hanover, Holstein, Lippe, Luneberg, Mecklenburg, Merseburg, Nassau, Oldenburg, East, West, and Rhenish Prussia, Pomerania, the Palatinate, Pymont, Reuss, Saxony, Schleswig, Silesia, Suabia, Thuringia, Waldeck, Westphalia, Wurtemberg, and the Isles of Rugen and Heligoland.

Distribution of *Helicigona arbustorum* (L.).

In the Counties and Vice-Counties
of the British Isles.

ENGLAND AND WALES.





Channel Isles	SOUTH WALES
PENINSULA	41 Glamorgan
1 Cornwall W.	42 Brecon
2 Cornwall E.	43 Radnor
3 Devon S.	44 Carmarthen
4 Devon N.	45 Pembroke
5 Somerset S.	46 Cardigan
6 Somerset N.	NORTH WALES
CHANNEL	47 Montgomery
7 Wilts N.	48 Merioneth
8 Wilts S.	49 Carnarvon
9 Dorset	50 Denbigh
10 Isle of Wight	51 Flint
11 Hants S.	52 Anglesey
12 Hants N.	TYNENT
13 Sussex W.	53 Lincoln S.
14 Sussex E.	54 Lincoln N.
THAMES	55 Leic. & Rutld.
15 Kent E.	56 Notts.
16 Kent W.	57 Derby
17 Surrey	MERSEY
18 Essex S.	58 Cheshire
19 Essex N.	59 Lancashire S.
20 Herts.	60 Lancashire Mid
21 Middlesex	HUMBER
22 Berks.	61 S.E. York
23 Oxford	62 N.E. York
24 Bucks.	63 S.W. York
ANGLIA	64 Mid W. York
25 Suffolk E.	65 N.W. York
26 Suffolk W.	TYNE
27 Norfolk E.	66 Durham
28 Norfolk W.	67 Northumb. S.
29 Cambridge	68 Cheviotland
30 Bedford	LAKES
31 Hunts.	69 Westmorland
32 Northampton	and L. Lanes.
SEVERN	70 Cumberland
33 Gloucester E.	71 Isle of Man
34 Gloucester W.	
35 Monmouth	
36 Hereford	
37 Worcester	
38 Warwick	
39 Stafford	
40 Salop	

SCOTLAND.

W. LOWLANDS	E. HIGHLANDS
72 Dumfries	93 Aberdeen N.
73 Kirkcudbright	94 Banff
74 Wigtown	95 Elgin
75 Ayr	96 Easternness
76 Renfrew	W. HIGHLANDS
77 Lanark	97 Westernness
E. LOWLANDS	98 Main Argyle
78 Peebles	99 Dumbarton
79 Selkirk	100 Clyde Isles
80 Roxburgh	101 Canire
81 Berwick	102 Ebudes S.
82 Haddington	103 Ebudes Mid
83 Edinburgh	104 Ebudes N.
84 Linlithgow	N. HIGHLANDS
E. HIGHLANDS	105 Ross W.
85 Fife & Kinross	106 Ross E.
86 Stirling	107 Sutherland E.
87 Pth. S. & Clkn.	108 Sutherland W.
88 Mid Perth	109 Caithness
89 Perth N.	NORTH ISLES
90 Forfar	110 Hebrides
91 Kincardine	111 Orkneys
92 Aberdeen S.	112 Shetlands

IRELAND.

ULSTER	LEINSTER
113 Derry	122 Louth
114 Antrim	123 Meath
115 Down	124 Dublin
116 Armagh	125 Kildare
117 Monaghan	126 Wicklow
118 Tyrone	127 Wexford
119 Donegal	128 Carlow
120 Fermanagh	129 Kilkenny
121 Cavan	130 Queen's Co.
	131 King's Co.
	132 Westmeath
	133 Longford
	CONNAUGHT
	134 Roscommon
	135 Leitrim
	136 Sligo
	137 Mayo E.
	138 Mayo W.
	139 Galway W.
	140 Galway E.
	MUNSTER
	141 Clare
	142 Limerick
	143 Tipperary N.
	144 Tipperary S.
	145 Waterford
	146 Cork N.
	147 Cork S.
	148 Kerry

-  Probable Range.
-  Recorded Distribution.
-  Distribution verified by the Author.
-  Geological Distribution.

NETHERLANDS.

Holland—Dr. E. von Martens and Van den Broeck record this species from Gelderland, Groningen, South Holland, and Zealand; while Mr. Sikes has found it in Friesland and North Holland.

Belgium—Reported by M. Jules Colbeau and others from Anvers, Brabant, Flanders, Liege, Luxemburg, Namur, and Grand Duchy of Luxemburg.

FRANCE.

Well distributed in the eastern provinces and departments, but only few records from the south and western districts. It is known to occur in the Ain, Aisne, Allier, Alpes Maritimes, Ardennes, Aube, Auvergne, Basses Alpes, Comtat, Côte d'Or, Dauphiny, Drôme, Doubs, Hautes Alpes, Haute Loire, Hautes Pyrénées, Haute Savoie, Isère, Jura, Loire, Loire Inférieure, Maine-et-Loire, Meuse, Moselle, Nièvre, Nord, Oise, Pas-de-Calais, Provence, Puy-de-Dôme, Rhône, Sarthe, Savoy, Seine, Seine-et-Marne, Seine-et-Oise, Seine Inférieure, Somme, Vienne, and Vosges.

ITALY.

Confined to the northern portions of the peninsula, and hitherto only reliably found in Lombardy, Piedmont, and Venetia, though reported from Emilia by Jan. The records for Sicily by Aradas and Maggiore are certainly erroneous as indicative of a natural habitat.

SPAIN.

Only reported from Camprodon and other localities in Catalonia, and from near Alar in Old Castile by Mr. E. J. Lowe.

AUSTRO-HUNGARY.

Helicigona arbustorum in this empire takes on some of its most interesting forms, and is probably found throughout the whole region, being definitely recorded from Austria, Bohemia, Carinthia, Carniola, Galicia, Hungary, Istria, Moravia, Salzburg, Styria, Transylvania, and Tyrol, while Dr. Picaglia adds Dalmatia.

SWITZERLAND.

Distributed throughout the country, and recorded from Aargau, Appenzell, Basel, Berne, Geneva, Glarus, Grisons, Lucerne, Neuchâtel, St. Gall, Schwyz, Solothurn, Thurgau, Ticino, Uri, Valais, Vaud, and Zurich.

BALKAN PENINSULA.

Roumania—Recorded by Clessin from Brostheni in Moldavia.

SCANDINAVIA.

Norway—Distributed throughout the country, probably to its most extreme northern limits, and ascending the mountains to an elevation of almost 2,000 feet in Maalselvdalen in the Amt of Tromsø.

Sweden—Found throughout the country, though not yet known around Stockholm; it also occurs on the Islands of Gothland and Oeland, and in Lapland at Sakok, where according to Odhner it inhabits the Upper Birch zone at an altitude of about 2,500 feet.

Denmark—Distributed almost over the whole kingdom, being recorded from Zealand, Jutland, Moen, Bogo, Lolland, Funen, and Bornholm.

Iceland—The sub-var. *fusca* found by Mr. W. Eagle Clarke in Sept. 1884 at Seydisfjord! and at Nordfjord in 1912 by Mr. F. H. Sikes.

RUSSIA.

Found chiefly in the western moiety of the country, being reported from the governments of Archangel, Courland, Esthland, Finland, Kharkov, Livonia, Podolia, Poland, Tauria, Tchernigov, and Vollynia. It is also found on the Aland Isles, the Islands of Moon, Osel, Hogland, etc.

ATLANTIC ISLES.

Dr. Gwyn Jeffreys quotes Madeira as inhabited by this species, but this is an error; he evidently consulted the Index to Lowe's *Primitiæ Faunæ Maderæ* without referring to the text; Mr. Lowe himself has pointed out this error.

NORTH AFRICA.

Recorded by Dr. Stecker from Tripoli, but not confirmed, and probably erroneous.

NEARCTIC REGION.

Dr. P. P. Carpenter cites this species as occurring in North America (Brit. Assoc. Report, 1863, p. 676); while Locard and Picaglia enumerate as inhabited regions "North America, Oregon, California," etc., all of which are probably erroneous.

AUSTRALASIAN REGION.

Dr. Kuster (Martini & Chemnitz, Monogr. *Helix*, pt. iv., p. 326) records this species as having been found at Verreaux, New South Wales, but the specimens were probably accidentally imported.



FIG. 507.—The "Winyats," or Gates of the Winds, near Castleton, Derbyshire, where *H. arbustorum* is plentiful (after photograph by Mr. R. Welch).

APPENDIX.

APPENDIX.

The additional information in reference to the *Zonitidae* and the various *Helicidae* treated of in the foregoing pages, acquired since the publication of the various parts composing the present volume, and the necessity of giving a complete description of *Vitrina hibernica*—an addition to the British fauna and to science—a species only detected subsequently to the issue of the part dealing with the *Vitrina*, renders it desirable to prepare this Appendix.

FAMILY ZONITIDÆ Mörch.

GENUS *VITRINA* Draparnaud.

Vitrina hibernica Taylor.

- 1907 *Vitrina elongata* Taylor, Irish Nat., Aug., pp. 225-231 and pl. 26 (not Drap.).
 1908 — *pyrenaica* Bowell, Irish Nat., May, pp. 94-98 and pl. 4 (not Fér.).
 1908 — *hibernica* Taylor, Monog. Moll., Oct., pt. xv. (cover).



HISTORY.—*Vitrina hibernica* (hibernia, Ireland), a species belonging to the group *Semilimax* and also new to science and to our fauna, was detected while examining the collections of Mr. P. H. Grierson, of Dublin, whom I have pleasure in associating with the species, which we owe entirely to his energy and his devotion to scientific pursuits.

Fortunately Mr. Grierson's systematic and precise method of collecting and registering his specimens enabled me to ascertain that this new species was found plentifully in Sept. 1904, also in June 1905, and on other occasions, in a locality near Collon, Co. Louth.

These specimens were first recorded by Mr. Grierson in Oct. 1904 (as *Vitrina pellucida* var. *depressiuscula*) in the Journal of Conchology, vol. xi., p. 125.

On attention being drawn to the importance of this discovery, search was made for living specimens, these being found without difficulty.

I brought forward this addition to our fauna at the Irish Field Club Conference, held at Cork, on July 11th, 1907, and the description with full details of the occurrence was published in the Irish Naturalist for August of that year, naming the specimens *Vitrina elongata* Drap. from a study of the shell only, under the idea that they were a form of that species, to which they bear a close resemblance.

In the following year the Rev. E. W. W. Bowell forwarded a communication to the Irish Naturalist, in which he expressed the opinion that the species was really the *Vitrina pyrenaica* of Férussac.

By the co-operation and help of the discoverer and other ardent collectors, a supply of living specimens was obtained, and these have been

closely studied in collaboration with Prof. Simroth, of Leipzig, our greatest authority upon the group, who is responsible for the dissections of the reproductive systems.

The result of this investigation shews that the Irish specimens, though intimately allied to *Vitrina elongata*, are really a quite distinct species, for which *Vitrina hibernica* is an appropriate name.

The facts upon which this statement was based were set forth on Oct. 3rd, 1908, on the cover of Part xv. of this Monograph, and the many anatomical details then given in its support are reproduced here.



FIG. 509.



FIG. 510.



FIG. 511.



FIG. 512.

FIGS. 509 and 511.—*Vitrina pyrenaica* Fér., as seen from beneath, enlarged (after Férussac).

FIG. 510.—*Vitrina pyrenaica* Fér., as seen from above, enlarged (after Férussac).

FIG. 512.—*Vitrina pyrenaica* Fér., as seen from above, natural size (after Férussac).

V. pyrenaica, however, would appear to be really an indeterminate or dubious species, as Férussac never described it, and so far as he is concerned the species is known only by his figures of the shell and the following precise description of the locality where it is supposed to have been found: *Helicolimæx* "*pyrenaica* nobis, pl. ix., f. 3—Habite les Pyrénées à 200 ou 300 toises au dessus des Eaux Bonnes, vallée d'Ossian près de Pic du Midi."

Specimens of a *Vitrina* have from time to time been collected at Eaux Bonnes and other places in France and Spain by various persons, which have been regarded and sometimes recorded as *Vitrina pyrenaica* by their collectors, but it is more than probable that these specimens do not represent the species here described as *V. hibernica*.

Abbe Dupuy, a celebrated and enthusiastic conchologist, and author of one of the most important standard works on the Mollusca of France, who lived within reach of the published locality, regarded *V. pyrenaica* as a myth, stating that although he had often and assiduously sought expressly for it on the precise and only spot indicated by Férussac, he had only found *V. beryllina* or *V. elongata* there, and seems inclined to regard the illustrations as unprecise figures of the former species; while M. Mermet, who so especially and thoroughly studied the molluscan fauna of the Western Pyrenees, could never find and indeed never saw the species.

Moquin-Tandon describes a *V. pyrenaica* in his work, and enumerates the places in which it is said to be found, but appears to have done so without personal knowledge, as they lack his usual mark of personal verification, and, further, his description does not apply to the animal inhabitant of the Irish shell, while his figure shows a much more globose and less degenerate shell than our *V. hibernica*.

The comparison of Férussac's figures with those of *Vitrina hibernica* show them to belong to a quite different species, and it is sufficient to note the much greater extension of the uncalcified membranous fringe to the basal margin of the aperture to clearly establish this.

As the name *pyrenaica* rests solely and entirely upon the figures of the shell, here reproduced, and no information whatever is given by its author in reference to the animal inhabitant or to any part of its internal organization, any opinion or judgment as to its identity or otherwise with other forms must necessarily be based solely upon the published figure of the shell.

Therefore no figure or description of the internal organs of the Irish species can have any possible bearing upon its relationship with the Pyrenean species, of which absolutely no knowledge exists in reference to the internal organization.

The figures and description of the organization of the Irish species by the Rev. E. W. W. Bowell (Irish Naturalist, May 1908, pp. 94-98, and pl. 4) which I regard as incorrect and misleading, are reproduced with this for comparison with the dissection by Prof. Simroth.

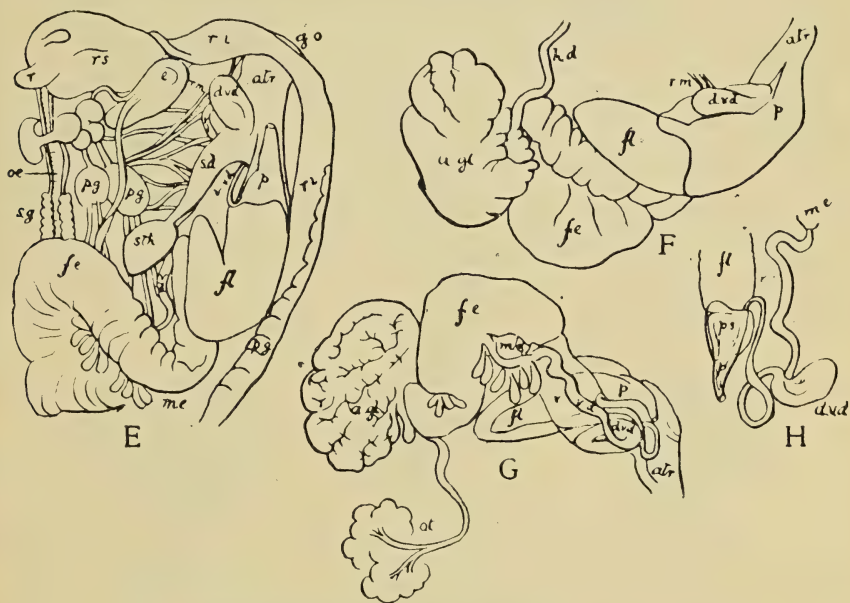


FIG. 513.—Dissection of *Vitrina hibernica* (after Bowell).

FIG. E.—Dissection intended to display portions of the Alimentary, Nervous, Muscular, and Reproductive systems, magnified (after Bowell).

FIGS. F. & G.—Reproductive organs isolated, to show their various parts, magnified (after Bowell).

FIG. H.—A portion of Male organs separated from the general system, magnified (after Bowell).

The following references are stated by the author to indicate:—

d.v.d., inferior dilatation of vas deferens; *fe.*, female portion of epididymis; *fl.* flagellum; *me.* male portion of epididymis; *æ.* oesophagus; *p.* male organ; *p.s.* penis sheath; *p.g.* pedal grooves; *r.s.* radula sac; *r.l.* the cut and reflected integument; *r.m.* retractor muscle; *s.g.* salivary glands; *v.* vagina.

For the references *atr.*, *a.gl.*, *e.*, *go.*, *hd.*, *ot.*, *sd.*, *sth.*, *v.d.*, and two sets of *p.g.* no explanations are given; while *sth.d.*, the spermathecal duct mentioned in the text, is not inserted in the figures, but is apparently represented by *s.d.*

Diagnosis.—*Vitrina hibernica* may be readily distinguished from its congener *V. pellucida* by its conspicuously smaller and flatter SHELL, by its fewer whorls, and by the broad membranous fringe to the basal margin of the aperture.

The ANIMAL differs not only by its total inability to withdraw within its shell, by its practically black overlapping mantle, and the absence of the black margin to the respiratory aperture, but by the possession on the anterior part of the body of five distinctly perceptible backwardly-directed furrows, arising from the supra-pedal grooves, *V. pellucida* only possessing four of these furrows.

INTERNALLY, it also differs from its ally by its indistinctly rostrate jaw; by the much simpler marginal teeth; and especially by the papillar adjunct to the reproductory system, an organ quite absent in *V. pellucida*.

Description.—ANIMAL pale translucent grey, overspread in front by innumerable very delicate vertical fulvous lineoles, which do not invade the dorsal or other furrows; the DORSAL FURROWS are distinct and continued on the muzzle; a suprapedal groove is placed well above the foot margin, from which spring five well marked, widely separated, and sub-parallel backwardly-directed grooves, the most anterior one being the GENITAL FURROW, which terminates at the genital orifice behind the anterior tentacle; the hinder end of the body is slender, of a translucent yellowish-grey, faintly blackish above, with a few widely-separated and indistinct lineoles, and projects beyond the shell when crawling; OMMATOPHORES thick, and of a pale translucent grey, but rendered opaque in part by the brown pigmented RETRACTORS, which are visible on the anterior part of the body as a brown lateral stripe; LOWER TENTACLES translucent yellowish-grey; FOOT-SOLE long, narrow, and faintly trifasciate, with the margins greyish, and a median yellowish area; the MANTLE is voluminous, with deep concentric wrinkles, and of a translucent grey, overspread with a number of irregularly-shaped large and deep black blotches, which give the organ an almost uniformly blackish aspect during contraction. The lobe entirely envelops the spire, conceals the right side and anterior margin of the shell by thick and concentric folds which are covered with deeply pigmented specks especially at the anterior margin; MUCUS thin, colourless, and transparent.

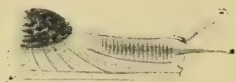


FIG. 514.—Diagrammatic representation of right side of *Vitrina hibernica*, showing the characteristic furrowing, $\times 4$.

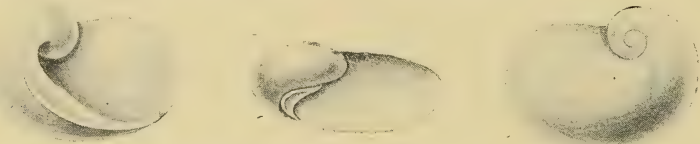


FIG. 515.—Shell of *Vitrina hibernica*, showing the basal, frontal, and upper aspects, $\times 6$.

SHELL haliotiform, very flat and compressed, thin and fragile, with indistinct growth lines, smooth, translucent, and brilliantly lustrous, with a yellowish and greenish tinge; WHORLS $2\frac{1}{2}$, rapidly increasing in size, the last constituting almost the whole shell; SPIRE not produced, and there is no umbilicus; APERTURE very large, transversely oval, and exceedingly oblique; columellar margin arcuate, basal margin almost straight, with a broad, flat and slightly wrinkled membranous margin, which is set at an angle to the convex shell, and frequently delimited by a perceptible ridge; upper margin sinuously excavated at its junction with the body-whorl and destitute of the membranous fringe.

Length 5 mill. ; breadth $3\frac{1}{2}$ mill. ; altitude 2 mill.

The shell when occupied by the animal usually appears to be of a deep fulvous colour, except towards the anterior border, where the HEART is placed, and is bounded posteriorly by the conspicuous and pale yellow RENAL ORGAN, just beyond the margin of the overlapping mantle edge.

The JAW or mandible is of an amber colour, flatly crescentic in shape, with distinctly recurved ends; it exceeds half-a-millimetre in length from side to side, and is of the usual oxygnathous type, with a strong chitinous projection or elasma behind; the median rostrum or beak is blunt and not prominent, with somewhat distinct vertical striae, which are continued upon the chitinous posterior prolongation; the remaining anterior surface of the mandible shows indications of striae more or less parallel with the upper margin.

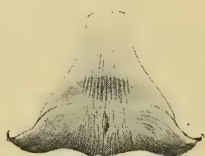


FIG. 516.—Mandible or jaw of *V. hibernica*, $\times 40$.

The RADULA is of the usual oblong shape, and in the specimen figured is composed of about 127 rows of 73 teeth each. The median row is distinctly tricuspid, a long and somewhat slender mesocone being flanked by a pair of comparatively insignificant ectocones; the laterals are thirteen in number, and also tricuspidate,

the ectocone being more basally placed and more strongly developed than the endocone, which gradually diminishes in size and prominence; the inner marginals are bifid, the endocone of the lateral teeth having become obliterated, and the ectocone also being much reduced in importance until at about the twentieth row it also disappears and the teeth become simply aculeate, the extreme outermost rows being quite rudimentary.

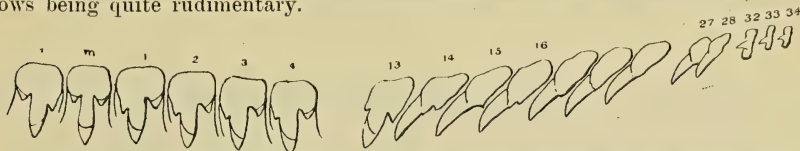


FIG. 517.—Representative teeth from the radula of *Vitrina hibernica*, showing median, lateral, and marginal teeth (from a highly-magnified photograph by Mr. W. Bagshaw of a preparation by Prof. Gwatkin).

Formula $\frac{24}{1.2} + \frac{13}{1.3} + \frac{1}{1.5} + \frac{13}{1.3} + \frac{24}{2.1} \times 127 = 9,525$ teeth.

The REPRODUCTIVE ORGANS show an OVOTESTIS composed of an oval aggregation of acini; the HERMAPHRODITE DUCT is short and almost direct, terminating near the base of the long and slender VESICULA SEMINALIS; the ALBUMEN GLAND is lobulated and ample; the OVIDUCT is sacculated and folded, continuing as a nearly straight FREE OVIDUCT, from whose upper section, the globose, short-stemmed SPERMATHECA arises; the SPERM-DUCT is slender and runs with the sacculate oviduct, being continued as the VAS DEFERENS to the short and stout



FIG. 518.



FIG. 519.

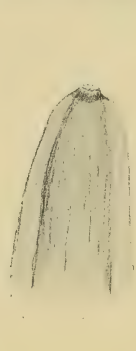


FIG. 520.

Reproductive organs of *V. hibernica*, after a dissection by Dr. Simroth.

FIG. 519.—Sexual system showing the arrangement of its various constituent organs, $\times 10$. *ot.* ovotestis; *alb. gl.* albumen gland; *a. g.* genital atrium; *d. gl.* dart gland, enclosing papilla or dart; *h. d.* hermaphrodite duct; *o.* free oviduct; *p.* penis sheath; *pap.* papilla; *sp.* spermatheca; *sp. d.* sperm duct; *ut.* uterus; *v. d.* vas deferens; *v. s.* vesicula seminalis.

FIG. 518 and 520.—Papilla from the dart-sac showing two of the stages of its development; more highly magnified. *d. gl.* dart gland; *pap.* papilla.

PENIS SHEATH, which it enters about midway; the DART GLAND is a long conspicuous organ, glandular at the distal end, and containing a papilla or dart, with a short crenulated chitinous crown, hardened or strengthened by chitinous rods, the length of the papilla varying in different specimens according to the development of the gland.

Habits and Habitat.—*Vitrina hibernica*, though found in other situations, apparently prefers the wooded portions of the country it inhabits, often congregating in the damper areas. It is very plentiful over a wide area of the ancient woodlands of Lord Massareene's Temple demesne at Collon, Co. Louth, where it was first found, the woods there being composed of native oak, beech, ash, etc., with planted larch, laurel, and various shrubs.

The ground is a cold wet clay, and it occurs amongst the fallen leaves of beech and various other trees, and on decaying branches, amongst moss, under stones, etc., the moss growing at the roots of grass is also a very favourite resort, but in the severe and snowy weather of April 1908 Mr. F. H. Sikes found them nestling at the roots of the sedges, though more numerous under the fallen leaves of the beech.



FIG. 521.—The woodlands of the Temple demesne, Collon, Co. Louth, the original locality for *Vitrina hibernica*, where it is very plentiful (after photo. by Mr. F. H. Sikes).

It is frequently found associated with *Vitrina pellucida*, *Pyramidula rotundata*, *Hygromia hispida*, or *Zua lubrica*.

It is a very alert and restless animal, not at all shy, and crawling actively about the moment it is touched or exposed to light, and is probably the most energetic of the woodland species, progressing an inch in fifteen seconds or even less, which is at the rate of a mile in about eleven days. The anterior portion of the body is usually only partially exerted, yet when the animal is in active movement the body is well protruded beyond the mantle margin.

In captivity it is a great cannibal, and when confined together they continually attack, destroy and devour what are probably the sickly or weaker individuals.

The pulse rate of a specimen when in active movement was found to be sixty contractions per minute at a temperature of 55° Fahr.

Geographical Distribution.—Though this species will probably be eventually found to be more widely diffused in Ireland than it is at present known to be, and may possibly also be discovered in some of the more remote districts of Great Britain, as well as certain parts of the European continent, it is as yet only reported from the counties of Louth and Meath in the east of Ireland.

Louth—Abundant within the Temple demesne near Collon, May and Sept. 1904 ! P. H. Grierson ; (the specimens recorded as *Vitrina pellucida* var. *depressiuscula* from Collon, Co. Louth, on p. 9 of the present volume are not that form but are the type shells of the present species) ; at roots of grass and herbage, amongst the ruins of a cottage between Collon and Monasterboice, May 1909, A. W. Stelfox ; among stones on top of a low wall by the Mattock River, Mellifont Abbey, May 1909, R. Welch ; and at roots of grass in Monasterboice graveyard, May 1909, R. Welch, A. W. Stelfox, and J. N. Milne.

Meath—On the south bank of the Mattock River opposite Mellifont Abbey, July 1912, R. Welch and A. W. Stelfox.

Vitrina pellucida (Müller).

1765 *Helix domestica* Ström, Trondhj. Selsk. Skrift., iii., p. 435, pl. vi., f. 15.

Synonymy.—To the various names included amongst the synonyms of this species, a few others may be added on the authority of reputable authors, amongst which are *Cobresia Helicoides vitrea* of Hübner; *Limacina pellucida* Hartmann; *Hyalina pellucida* Studer; *Vitrinus pellucidus* Mont.; and *Helicolimax pellucida* of Férussac.

The *Helix domestica* of Ström, too, is almost surely identical with *Vitrina pellucida*. It is described as follows:—

Original Description.—" *Helix domestica*. This name I give to a little snail, which is represented by fig. 15, since I find nothing in Linné's Systema Nat. to which I can with certainty refer it. It is small, ovate-rounded, and somewhat convex above, and shows three small and flat whirls on the one side. The aperture is large and may be called almost entirely round, and the columella, or part attached to the snail's house, comprises a small segment, or may be inscribed in an exact circle. The shell is yellowish, and so brittle that one cannot pick it up without breaking it in pieces. It contains a bluish snail. It is found in great numbers under the moss or turf on houses, and is sometimes fully as large as the figure, which represents both the upper and lower sides."—HANS STRÖM, Trondhj. Selsk. Skrift, 1765, iii., p. 435, pl. vi., f. 15.

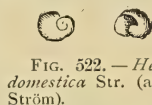


FIG. 522.—*Helix domestica* Str. (after Ström).

Enemies.—This species has been observed though rarely at Thrush-stones in North Lincolnshire, by the Rev. E. A. Woodruffe-Peacock.

Geographical Distribution.—The number of counties or vice-counties for which the occurrence of *V. pellucida* has never been verified have been diminished, as it has now been found in North Wiltshire in England by Mr. Swanton; Carlow in Ireland by Mr. Phillips; South Eludes by Rev. J. E. Somerville; while North Aberdeen in Scotland, was added in the course of our investigations into the northern range of our mollusca, by the aid of a government grant for that purpose.

The record of the occurrence of the var. *depressiuscula* Jeffr., at Collon, co. Louth (see p. 9), has reference to *Vitrina hibernica*, and not to the present species.

Our knowledge of its continental distribution has also been increased by its reported occurrence in South Holland and Utrecht, Netherlands; and at Solothurn in Switzerland.

GENUS *HYALINIA* Charp.

SUB-GENUS *Euhyalinia* Albers.

The species of this group are, as pointed out by Prof. Gwatkin, a very distinct section, differing by the character and number of the radular teeth from the *nitidula* group.

The Rev. E. W. W. Bowell in a suggested arrangement of the *Euhyalinia* based upon their anatomical structure, links together as having the most intimate relationship, *hibernica* and *scharffi*; also *cellaria* and *rogersi*; and finally *helvetica* and *alliaria*.

Mr. Bowell also states that he believes that the great variation in the genitalia and radula observed within the limits of certain species is due largely to the species hitherto recognized being composite.

Prof. A. E. Boycott has, however, demonstrated that certain variations observed in the number and character of the radular teeth in *Hyalinia helvetica* are attributable to the size and age of the animal, and this explanation of the differences noted doubtless applies to the genus generally.

The *Hyalinia* are described by Prof. Westwood as the chief prey of the Glow-worm (*Lampyris noctiluca* L.), which in its larval and perfect stages is a very voracious enemy.

A certain amount of variation in the character of the shell in this as in other genera is attributable to the special environment under which the animals live. In very dry or exposed situations the shell, as observed by Macgillivray, is thicker, firmer, and more opaque; while in damper and more shady situations the shells are thinner and more fragile.

Hyalinia lucida (Drap.).

Nomenclature.—As stated on p. 18, the name *lucida* was bestowed by Prof. Draparnaud on this species in 1801, in his "Tableau Moll.," but by error or design this name was in his posthumous "Histoire" applied to the species now known as *Zonitoides nitidus*, and the name *nitida* is still affixed to the Draparnaudian type specimens of *H. lucida* in the Imperial Museum of Vienna.

Prof. Draparnaud's figures and the original description of this species are here reproduced for convenience of reference.



FIG. 523.—*Hyalinia lucida* (Drap.), natural size (after Draparnaud).

Helix nitida = *Helix lucida* Tableau des Moll., n. 46, p. 96. SHELL thin, flat, and transparent; a little convex, and clear horn colour above; milk-white, tinged with greenish, and more glossy beneath. The surface is smooth, very delicately striate, and often bearing very small scales or lamellæ, due to the nature of its caducous epidermis. SPIRE composed of 5 whorls, of which the last is much larger proportionately. SUTURE well marked, often accompanied by a very slender and often brownish line. APERTURE large, semi-oval, and oblique, strongly encroached upon by the penultimate whorl, the upper margin extending beyond that of the columella, peristome simple and direct. UMBILICUS expanded.—DRAPARNAUD, Histoire des Moll., 1805, p. 117, pl. viii., ff. 23-25.

Geographical Distribution.—The records of the distribution have been increased by its discovery in the Isle of Alderney and in the counties of Cardigan, Carnarvon, and Northampton.

In Ireland it has been recorded from East Galway and Kerry. The late Mr. W. Moss had specimens from Belfast, co. Down, their identification being verified anatomically; while Mr. A. W. Stelfox remarks that in many places in Munster and Leinster it is the most plentiful *Hyalinia*, especially in the vicinity of dwelling-houses, and adds to its known range the counties of Meath, Kildare, Tipperary, Clare, Wexford, and Waterford.

It has also been introduced into various hot-houses in Cork, Dublin, Antrim, Down, Fermanagh, etc., and appears to thrive under such conditions; but the Antrim records are considered by some of the Irish conchologists to be really referable to the *H. hibernica* of Kennard, which is a sub-variety of *Hyalinia cellaria*.

In France, Mr. F. H. Sikes has added to its known range the departments of the Eure, Eure-et-Loir, Indre-et-Loire, Loir-et-Cher, and Saône-et-Loire; while M. Coutagne has recorded it as very common throughout the Bouches-du-Rhône.

In Norway, it is reported from Krageró, near Christiania, by Mr. H. Sell.

ETHIOPIAN REGION.

South Africa—Recorded by Major Connolly from Rondebosch and Kenilworth, Cape Peninsula.

NEARCTIC REGION.

United States—Recorded by Prof. T. D. A. Cockerell as common in greenhouses at Boulder, Colorado.

Hyalinia cellaria (Müller).

1907 *Vitrea (Hyalinia) hibernica* Kennard & Bowell, Irish Nat., Nov., pp. 325-329, and pl. 42.

1908 — *scharffi* Kennard & Bowell, Proc. Mal. Soc., March, pp. 50-56, and figs.

The type specimens of this species are, according to Major Connolly, still preserved in the Müllerian collection deposited in the Zoological Museum of Copenhagen University.

The shells of *H. cellaria* are occasionally found at Thrush-stones in Lincolnshire, according to observations of Rev. E. A. Woodruffe-Peacock.

Geological History.—The records of its occurrence in the Holocene deposits have been increased by Messrs. Kennard and Woodward, who found specimens at Ightham, West Kent, in the old surface-soil at base of a grave of early Romano-British age in Stanley's Quarry and commonly in a deposit at Allen's Farm.

In South Somerset, it was found plentifully with human remains during the excavations by Mr. H. St. George Gray of Wick Barrow (Pixie's Mound), Stoke Courcy, but by error were recorded as *H. alliaris*. Mr. Swanton also records it from Brean Down, near Weston-super-Mare. In North Somerset, Mr. Musson has recorded that there are specimens in the Bath Museum, found amongst powdered quartz, in two "stone coffins," discovered buried 12 feet beneath the surface, at Bathwick Hill.

In Bucks., Mr. J. E. Cooper detected it in the alluvial brick-earth at Boveney.

In North Lincoln, Mr. J. F. Musham has found it at Greetwell.

In South-east Yorkshire, the Rev. E. P. Blackburn has recorded the finding of specimens by Mr. J. R. Mortimer in "barrows" of the Bronze age at Birdsall Brow, and at Willie Howe plantation, near Sledmere.

In Mid-west Yorkshire, Mr. J. Wilfrid Jackson discovered it at Mitton Bridge, Ribblesdale.

In Westmorland, Mr. J. Wilfrid Jackson records it from the lacustrine deposits about Hale and Burton-in-Kendal.

In France, it has been found by M. Cardot in calcareous tufa at Malandry, Ardennes.

Variation.—The modifications of the shell of this species have at various times been elevated into distinct species upon more or less insufficient grounds by different collectors; but their claims to specific status are now generally disallowed by the consensus of matured opinion.

Var. **compacta** Jeffreys.

Dr. Jeffreys probably included with this variety the *Hyalinia lucida* Drap., but this does not necessarily invalidate the name he used, although the supposition that such is the case has led to the proposal to call this form *sydneyensis*, a name published by Dr. Cox in 1864 to distinguish the Australian specimens of *Hyalinia cellaria*.

This variety, which is evidently in a great degree of a transitional character, has naturally been especially fertile in affording suggested new species, and two closely allied varieties of *H. cellaria* (Müll.), which are perhaps best included under the var. *compacta*, have in recent years been brought forward by Messrs. Kennard and Bowell as new to science under the names of *Vitrea scharffi* and *Vitrea (Hyalinia) hibernica*, and although in their most characteristic form these proposed species may be readily distinguishable conchologically from typical *cellaria*, yet they have not hitherto been demonstrated to possess any sufficiently constant and reliable characters to entitle them to specific rank.

The sub-var. *hibernica* was brought forward in the Irish Naturalist for Nov. 1907, as *Vitrea (Hyalinia) hibernica*, which contained a description and figures of the shell and some account of the organization with illustrations by the Rev. E. W. W. Bowell, and although Dr. Böttger, to whom specimens were sent by Mr. Kennard for determination, remarked:—"The *Hyalinia* from Murlough Bay I have as *cellaria* var. *compacta* Jeffreys from Gill's Bay, Caithness," yet Messrs. Kennard and Bowell decided to describe it as a new species.

Mr. A. W. Stelfox and others, who have especially studied this question, practically regard all full-grown Irish specimens of *H. cellaria* as referable to *hibernica*, the only exceptions being those inhabiting some of the eastern counties, which do not appear to grow beyond the usual size of English specimens.

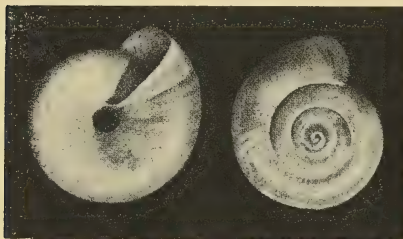


FIG. 524.—*Vitrea (Hyalinia) hibernica* K. & B., × 2, Rostrevor, Down (after Kennard).

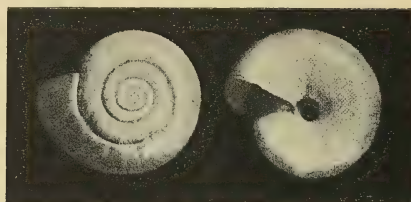


FIG. 525.—*Hyalinia cellaria* Müll., × 2, Lancaster, (after Kennard), for comparison.

The shell is described by Mr. A. S. Kennard as:—

***Vitrea hibernica* n.sp.**—SHELL somewhat convex above, less so beneath, thin, glassy, semitransparent, pale horn-colour above, clouded white beneath; STRIÆ parallel with the mouth and more pronounced at the suture; WHORLS 5-6, body-whorl about half the size of the shell; SPIRE slightly produced; APEX blunt; SUTURE shallow and grooved; MOUTH semilunar and somewhat oblique; UMBILICUS narrow and deep. Height 6-7 mm. Breadth 11-14 mm. It can be distinguished from *V. cellaria* by the greater height of the spire and by the more oblique mouth; this last being very noticeable in adult examples, though less so in immature specimens (pl. 42, fig. 4-7).

The Rev. E. W. W. Bowell describes the specimens of *hibernica* as larger than the average *cellaria*, and the animal as having the body of a dark slate-blue colour somewhat resembling the tone of the pigment known

as ultramarine-ash, the epidermic cells are also said to be more opaque than in *cellaria*, and more symmetrical in their distribution, while brown or black-branched pigmentary bodies are not present.



FIG. 526.



FIG. 527.



FIG. 528.

FIG. 526.—Proximal portion of the genitalia of *Hyalinia hibernica* Kennard and Bowell (after Bowell).

FIG. 527.—Buccal bulb of *H. hibernica* (Kennard and Bowell), showing the cesophagus, radula-sac, and retractor.

FIG. 528.—Buccal bulb of *H. cellaria* (Müller), showing the cesophagus, radula-sac, and retractor.

He is also responsible for the dissections of the animal, and remarks on the stronger build of the organs generally compared with *H. cellaria*; the spermatheca is described as being flat and spoon-shaped, very different from the globose spermatheca of *H. cellaria*, a state, however, probably due to the vesicle being empty at the time of examination; the duct is also stated to be twisted and longer; while the penis, epiphallus, and the dilatation of the vas deferens are large and distinct, and he regards the organs generally as more suggestive of *H. lucida* than *H. cellaria*, but admits the great variation due to the physiological age and condition of the individual.

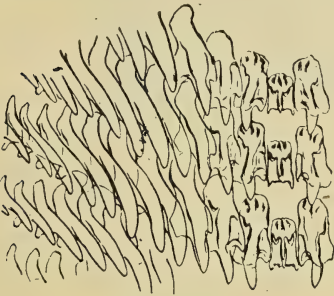


FIG. 529.

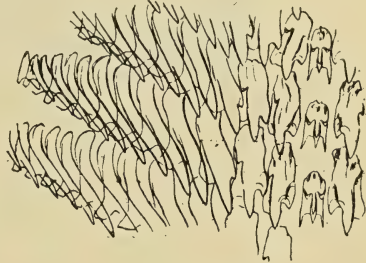


FIG. 530.

FIG. 529.—Half a transverse row of the radula of *H. hibernica* K. & B., highly magnified (after Bowell).

FIG. 530.—Half a transverse row of the radula of *H. cellaria* Müller, highly magnified (after Bowell).

The radula of *hibernica*, though occasionally approximating to that of typical *cellaria*, is yet said to be readily distinguishable therefrom by the greater thickness and prominence of the outer and central teeth, which are consistently more compact and oblong.

Geological Distribution.—In a fossil state it is recorded by Mr. A. S. Kennard from Drumcliffe Crannoge, and Clanreen Crannoge, in co. Clare, collected by Miss Parkinson; and from a rainwash at Dog's Cave, Ennis, in the same county, by Mr. R. Welch.

Geographical Distribution.—Mr. A. S. Kennard cites the following localities for this form, and others have been reported from time to time by various collectors.

ENGLAND.

Westmorland and Lake Lancashire—Grange, J. Wilfrid Jackson.

IRELAND.

Antrim—Murlough Bay, R. Welch. Rathlin Island, L. E. Adams.

Down—Rostrevor, A. W. Stelfox.

Mayo W.—Clare Island, A. W. Stelfox.

Limerick—Rathkeale, H. Fogerty.

Waterford—Near Youghal, A. W. Stelfox.

Cork S.—Rostellan and Carrigrohane, A. W. Stelfox.

Kerry—Kennmare and Killarney, A. W. Stelfox. Beginnish Island, Miss Delap.

The sub-var. *scharffi* is another form of this species which Kennard and Bowell have described and proposed to raise to distinct specific rank as *Vitrea scharffi* and which the authors regard as having been confused with *H. helvetica* by the celebrated conchologists, Dr. O. Böttger, Dr. Blum, Dr. Westerlund, etc., a strange and very unlikely circumstance; they also regard their proposed species as confused with *lucida*, *cellaria*, *helvetica*, or *nitidula* by other writers.

Mr. Stelfox and other Irish conchologists regard this form as immature examples of the conical, highly polished, woodland form of *H. cellaria*.

The shell is described by Mr. Kennard as:—

Vitrea scharffi.—SHELL convex above and beneath, very glossy, light fulvous horn colour above, opaque white beneath, with irregular curved striae parallel with the mouth. WHORLS $5\frac{1}{2}$, body-whorl about half the size of the shell; SUTURE shallow; UMBILICUS narrow and deep. Altitude 6 mm.; diam. 12 mm.

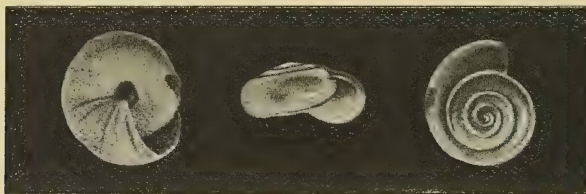


FIG. 531.—*Vitrea scharffi* K. & B., Cloughjordan, Tipperary (enlarged about one-third), after Kennard.

Mr. A. S. Kennard further adds that there is but little difficulty in distinguishing *H. scharffi*, for its colour is very striking and quite sufficient to separate it from either *H. lucida*, *H. cellaria*, or *H. hibernica*.

Compared with *H. cellaria* it is larger, more robust, and with a much smaller umbilicus, whilst it may readily be distinguished from *H. lucida* by the last whorl not being so expanded, and from *H. hibernica* by the smaller umbilicus and far more polished surface.

The organization of the animal is described by Mr. Bowell, who also remarks that the external aspect of *V. scharffi* bears a strong superficial resemblance to *nitidula*, most striking in living specimens, the prevailing tint of the animal of *scharffi* being dull-brown, more or less flecked with small patches of black, but not forming a pattern or lines.

The authors of this proposed species are, however, far from being in accord with each other as to the essential characters and affinities of the shell, Mr. Kennard as above, comparing it with and pointing out its distinctions from *H. lucida*, *H. cellaria*, and *H. hibernica*, while his collaborator, on the contrary, describes the shell as answering to the description of *H. nitidula* var. *nitens*, but possessing a radula like that of *cellaria*, and stating that he always closely examines any doubtful *nitidula*, and these if not *nitidula* are generally *scharffi*.

The ALIMENTARY SYSTEM presents no special features, but Mr. Bowell states that the SALIVARY-DUCTS are long and twisted.

The BUCCAL MASS resembles that of *V. hibernica*, but is more oblong; the JAW has a not very prominent beak; the short ELASMA is connected with the maxilla



FIG. 532.



FIG. 533.



FIG. 534.

FIG. 532.—Frontal aspect of the maxilla or jaw of *H. scharffi* $\times 25$ (after Bowell).

FIG. 533.—Under aspect of the maxilla or jaw of *H. scharffi* $\times 25$ (after Bowell).

FIG. 534.—Rear view of the maxilla or jaw of *H. scharffi* $\times 25$, showing the projecting dark area of muscular attachment (after Bowell).

muscle, while the large muscle to the maxilla has a sheath marked by regular transverse striation.

The RADULA, in Mr. Bowell's opinion, is probably sufficient for identification; the points being the small number of marginals, seven or eight as against ten or twelve usually found in the species of the group; juveniles of *cellaria* might have only seven or eight, but their centrals and laterals are of an easily recognizable type. The shortness of the cusps so that the rows hardly overlap is another feature. The transitional or third lateral is only distinguishable from the marginals by a very slight bicuspidation. The median teeth resemble those of *Vitrea hibernica* and the general configuration of the basal plates is also similar. The radular variation seen is in the form of accessory endocones to the median teeth; central and first lateral fused; second lateral with bifid endocones. In two specimens the marginals were much shorter than figured, and huddled together, after the fashion of the true *nitidula*.

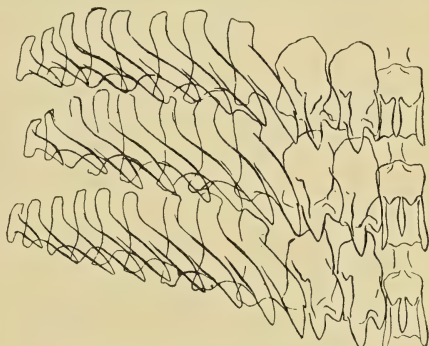


FIG. 535.—Half a transverse row of the radula of *H. scharffi* (highly magnified) after Bowell.

INTERNALLY, in the REPRODUCTIVE or SEXUAL SYSTEM of this sub-variety the OVOTESTIS forms in the specimen figured a voluminous mass, with four or five ducts;



FIG. 536.



FIG. 537.

FIG. 536.—Reproductive organs of *Hyalinia scharffi* (after Bowell), reduced from the original figure.

FIG. 537.—Alimentary system of *H. scharffi*, showing the heart and renal organ, the digestive gland, the buccal bulb, retractor muscle, etc. (after Bowell), reduced from the original figure.

the HERMAPHRODITE DUCT is very long and wide, and but little convoluted, and apparently provided with valves in its course formed by a kind of intussusception;

ALBUMEN GLAND slug-shaped, the duct joining it in a trifid groove above the middle; the EPIDIDYMIS has $2\frac{1}{2}$ complete turns between the albumen gland and entry of the vas deferens, and when the oviducal part is distended the epididymis forms a compact sub-oval organ, but the number of turns is not increased; VAGINA long, dividing into two branches above; one is bent on itself and joins the oviduct, the other is S-shaped, and is the stem of the spermatheca; a small eminence between them may be a vestigial diverticulum; SPERMATHECA spoon-shaped, the flat side attached to the middle of the epididymis is thinner and softer than the convex outer surface, but when distended it is of a more globular form; the VAGINA is joined to the very short atrium by a semi-circular duct, with an oval glandular jacket; the lower part of the organs are enclosed in loose connective tissue; PENIS remarkably long, with two flexures, the part between the flexures is the true penis; the VAS DEFERENS enters near the distal end, where a stout muscle is fixed, which is coiled, and has a termination suggestive of a rudimentary flagellum; the superior dilatation of the vas deferens is unusually large, with a sigmoid flexure, a large muscle arising from its lower end. Though there is variation in the slenderness or tumidity of different parts, the remarkable flexures of the spermathecal duct, vas deferens, and vagina appear to be always present.

Hyalinia scharffi has hitherto been found chiefly in Ireland, but there are also many localities recorded in England, but few as yet from other countries. The authors cite the following:—

ENGLAND AND WALES.

Hereford—Ross-on-the-Wye, Rev. E. W. W. Howell.

Westmorland and Lake Lancashire—Grange, Seathwaite, and Broughton-in-Furness, A. S. Kennard.

SCOTLAND.

Orkneys—Near Stromness, A. S. Kennard.

IRELAND.

Down—Morru, A. S. Kennard.

King's Co.—Birr, A. S. Kennard.

Sligo—Knocknaree Glen and Donegal Priory, Lough Gill, A. S. Kennard.

Galway W.—Salthill and near Ross, A. S. Kennard.

Galway E.—Loughrea, A. S. Kennard.

Clare—Kilrush, R. A. Phillips.

Tipperary N.—Cloughjordan, Borrisokane, and Nenagh, A. S. Kennard.

Waterford—Youghal, A. S. Kennard.

Cork N.—Youghal and Whitegate, A. S. Kennard.

Cork S.—Carrigrohane, Ballinspittle, and Bantry, A. S. Kennard.

Var. *complanata* Jeffreys.

This variety has been found at Port St. Mary, Isle of Man, and other places since the publication of Part xiv. It has also been recorded from the Ardennes by M. H. Cardot.

Var. *margaritacea* Schmidt.

In Ireland, this albino form is said to be chiefly confined to the south and west, and its range has been increased by its occurrence in Queen's co., while it is the prevailing and indeed only form in many of the churchyards of West Mayo. Other comital or vice-comital districts in which it has been noted are Armagh, Carlow, Cork, East Galway, and Meath.

In England, its distributional area has been increased by the addition of Middlesex and North and South Somerset.

Geographical Distribution.—The range of the typical form has also been extended in Africa by the labours of Major Connolly, who records it from Buluwayo in Rhodesia, and states that it is now widely distributed in the South African peninsula.

Hyalinia helvetica (Blum).

Synonymy.—This species was believed by the late M. Bourguignat and many continental conchologists to be the true *H. alliaria* of Miller, M. Bourguignat basing his belief on receiving specimens from Lovell Reeve and other English conchologists under that name.

Diagnosis.—The sinuate upper margin of the aperture shown in the figures of this species (see pl. 6) though an usual feature of the shell, cannot be absolutely relied upon as a specific character.

The dissections by the Rev. E. W. W. Bowell of a continental specimen of *Hyalinia helvetica* and of what he terms *Vitrea rogersi* are given for comparison with each other and with those given on p. 48 which represents the form presented by a very large number of dissections and drawings of British specimens.

According to Mr. Bowell, the proximal parts of the genitalia in the continental *H. helvetica* show an extremely short vas deferens, commencing two-thirds of the way down the penis-sheath, and a shoe-shaped spermatheca with a short, stout and twisted duct, while he states that *rogersi* has a soft and flexible stem, which he figures as of a very abnormal length, while the flexures of the vas deferens shown in the figure are, he observes, found to exist almost uniformly.

The radula of *H. helvetica* Blum, from Solothurn, is in the opinion of Mr. Bowell, a very characteristic organ, and by it, he says, the species may be distinguished from other *Vitrea*, the central tooth being small, its basal plate remarkably quadrate, and the central cusp long. There are only two well-developed laterals, and these are also remarkable for the squared character of their basal plates; their mesocones and endocones are of a compactly rounded shape, and the ectocones are closer than usual to the mesocones on account of the abbreviated shape of the teeth. There are 13 to 16 closely-set marginals, with very curved basal plates, and cusps of average length, which only slightly overlap the next row, the first marginals may be regarded as either transitional, or as a first marginal, being furnished with a slight endoconic prominence.

The radula of *rogersi*, from Westerham, is stated by Mr. Bowell to be very non-significantly variable, and due mainly to looseness of build, the central tooth being frequently asymmetrical, with a considerable variation in the length of the mesocone, which is rounded or ovate in shape, and may bear an additional ectocone on one side. The exact shape of the admedian is also said to be very variable, and their mesocones are more slender, while the ectocones show a tendency to disappear, or are so reduced as to suggest a serration; and one never sees the neat and distinct quadration of the basal plate, said to be so strongly marked in

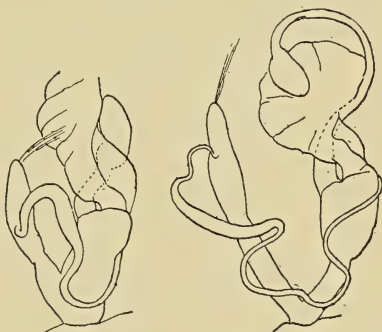


FIG. 538.

FIG. 539.

FIG. 538.—Dissection of the proximal part of the Reproductive system of *H. helvetica* Blum, from Solothurn, enlarged (after Bowell).

FIG. 539.—Dissection of the proximal part of the Reproductive system of *H. rogersi* B.B.W., from Westerham, enlarged (after Bowell).

helvetica; the marginals are comparatively short and not closely set, and affirmed to be totally unlike either *helvetica* or *glabra* Studer.

The abnormality in admedian teeth of the radula of the specimen of *H. helvetica* upon which Mr. B. B. Woodward in a large measure founded

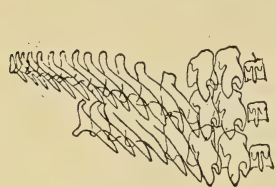


FIG. 510.



FIG. 511.



FIG. 512.

FIG. 510.—Half a transverse row of the radula of *H. helvetica* Blum, from Solothurn, highly magnified (after Bowell).

FIG. 511.—The median and abnormal admedian teeth of B. B. Woodward's type specimen of *H. helvetica* Blum, from Solothurn, highly magnified (after Bowell).

FIG. 512.—Half a transverse row of the radula of *H. rogersi* B. B. Woodward, from Westerham, highly magnified (after Bowell).

his opinion of the distinctness of British specimens, is stated by the Rev. E. W. W. Bowell to be due to a group of cells which normally fill the cavity between the mesocone and the endocone to prevent the advance of chitinization there, becoming themselves impacted within the cavity and chitinized.

Mr. Bowell has also affirmed other points of difference to exist between the continental *H. helvetica* and the English form which Mr. Woodward named *V. rogersi*, the chief of which would appear to be the attribution of an enormous length to the stem of the spermatheca; but in this it is probable there is some grave error, or if correct it leaves room for doubt as to the species actually under examination.

ENGLAND AND WALES.

Devon N.—Braunton, May 1912 ! Mrs. Longstaff.

Somerset N.—Crech Hill near Bruton ! F. A. Knight. Weston Wood, Bath ! Kenneth McKean.

Sussex W.—East Dean, Sept. 1901, C. E. Wright.

Essex S.—Epping, Sept. 1886 !

Oxford—A richly coloured shell, Howe Woods, Watlington, May 1909 ! W. Denison Roebuck.

Norfolk E.—Costessey, 1908 ! A. Mayfield.

Worcester—Recorded as *V. rogersi* from Lincomb in "Victoria County History of Worcestershire," by B. B. Woodward.

Monmouth—Abergavenny and Wynd Cliff, April 1909 ! F. H. Sikes.

Glamorgan—Common about Swansea, Oct. 1901 ! C. Oldham.

Brecon—Llanerchwdldland Wells, April 1909 ! F. H. Sikes.

Radnor—Llanbychlyn Pool, Sept. 1909 ! J. Williams Vaughan.

Cheviotland—Chillingham, Aug. 1909 ! W. Denison Roebuck.

Cumberland—Bassenthwaite, 1901 ! W. J. Farrer.

IRELAND.

The Irish records of this species have been challenged by Mr. A. W. Stelfox and other Irish conchologists, who believe the specimens recorded as *H. helvetica* to have been really the form of *H. cellaria*, named by Kennard and Bowell *Vitrea scharffi*, and Mr. Kennard also states that Prof. Böttger, Dr. Westerlund, Dr. Blum, and others have all misnamed the specimens submitted to them, as he has seen some of the shells referred to, and affirms that they include both *hibernica* and *scharffi* and are not *helvetica*.

Var. **viridans** Ckll.

ENGLAND AND WALES.

Middlesex—One example found near Hendon (Cooper & Loydell, Middlesex list, p. 222, April 1909).

Leicester—One example on a small patch of carboniferous limestone, Rev. C. E. Y. Kendall, May 1909.

Hyalinia alliaria (Miller).

1912 *Polita alliaria* Connolly, Ann. South Afr. Mus., vol. xi., p. 59.

Geological History.—*H. alliaria* has been found in the Holocene old surface-soil at the base of a grave of early Romano-British age in Stanley's Quarry, Ightham, West Kent, and in the deposit near Carricknamoyla on the Isle of Inishbofin, off the coast of West Galway, Ireland.

In Mid-west Yorkshire, Mr. J. W. Jackson has found one specimen in a hill-wash of probably Neolithic age at Clapdale, Clapham.

Erroneously recorded as found plentifully with human remains at Stoke Courcy, South Somerset, in 1907, by Mr. H. St. George Gray.

Variation.—The variability of this species in Ireland has been discussed by Mr. A. W. Stelfox, who remarks that in some old woods, especially in the south-western districts, a smaller, more narrowly umbilicated and more conical shell is often found, which contrasts greatly with the larger, duller and flatter western form living in more exposed situations, which he thinks may be referable to the var. *anceps* of Westerlund, a native of Sweden.

Its altitudinal range, according to the observations of Mr. A. W. Stelfox, extends in Western Mayo to a height of 1,500 feet, but on the Dingle peninsula in Kerry it attains the summit of Brandon Mountain, which rises to a height of 3,127 feet above the sea.

Geographical Distribution.—This species is as yet far from being correctly understood, and its range will be no doubt materially increased as its distinctive characters become more generally recognized.

Several of the comital and vice-comital areas in the British Isles, from which it was previously apparently absent, have been added to the list of the inhabited districts; the Scottish one—North Aberdeen—by the aid of a government grant for the investigation of the northern range of our land mollusca.

Its foreign distribution has also been increased by the knowledge of its presence in East Prussia and Suabia.

FRANCE.

Bouches-du-Rhône—The occurrence of this species in the delta of the Rhône has recently been established by Mr. B. R. Lucas.

Basses Pyrénées—M. Granger records it from Bayonne and St. Jean de Luz.

SCANDINAVIA.

Denmark—It is reported from Skaritso and Viborg, Jutland, by Mr. Sell; and Steenberg records it as widely distributed but rare in East Jutland and upon the islands.

Iceland—Mr. F. H. Sikes reports it from Isafjördr and Hafnafjördr on the north-west coast.

ETHIOPIAN REGION.

Cape Colony—Major Connolly records the occurrence of this species at Grahamstown, on the authority of Mr. Farquhar.

Var. *viridula* Jeffr.

ENGLAND AND WALES.

Kent E.—Hunton ! F. H. Sikes.

Merioneth—Fairly common, Fairbourne, A. H. Jowett-Murray.

Northumberland S.—Kielder, Sept. 1909 ! A. T. Gillanders.

SCOTLAND.

Ebudes S.—Craighouse, Isle of Jura, June 1908 ! J. F. Musham.

Ross W.—Balmacarra, Sept. 1906 ! Rev. R. Godfrey.

IRELAND.

Monaghan—Castleblayney, 1907 ! P. H. Grierson.

Fermanagh—Fermanagh ! R. Welch.

Wexford—New Ross, Oct. 1907 ! R. A. Phillips.

Queen's Co.—Abbeyleix, Sept. 1907 ! R. A. Phillips.

Leitrim—Leitrim ! P. H. Grierson.

Mayo E.—Ballinchola ! C. E. Wright.

Mayo W.—Commoner than the type form, especially on the islands ! A. W. Stelfox.

Galway E.—Clonbrock, July 1907 ! R. Welch.

Tipperary N.—Finnoe, not numerous (Smith, Nat. Hist. Rev., 1854, p. 85).

Cork S.—Glengarriff, April 1909 ! R. F. Scharff.

SUB-GENUS *Polita* Held.*Hyalinia nitidula* (Drap.).

Nomenclature.—The correctness of the application of the name *nitidula* to the present species has recently been challenged by several writers, some of whom believe that *Hyalinia pura*, which Draparnaud's figure in their opinion more resembles, was intended to be indicated.

This opinion they consider is strengthened by his inclusion of *Hyalinia radiatula* as a variety ; but it must be remembered that Draparnaud expressly described the variety as *much smaller*, and figured it as such. An examination of Draparnaud's original description and figures will allay any doubts that may exist in this respect.

For the convenience of those not able to conveniently consult Draparnaud's work, the original diagnosis given on p. 68 is now supplemented by the original description and a copy of his figure, the latter by some error of the author or printer being attributed therein to *Helix crystallina*.

Original Description.—*H[elix]. nitidula*.—ANIMAL pearly-grey, with black and white specklings.

The SHELL strongly resembles the preceding [*Hyalinia lucida*], of which it may well be merely a variety, but is smaller, a little less glossy, and a little less white beneath. The APERTURE is a little narrower, less oblique, and less encroached upon by the penultimate whorl, and the two margins approximate at their insertions. The UMBILICUS is also wider or more expanded. The SPIRE has four whorls only.—DRAPARNAUD, Hist. Moll. France, 1805, pp. 117-118, pl. 8, f. 20.



FIG. 543.



FIG. 544.

FIG. 543.—*Helix nitidula* (Drap.), natural size (after Draparnaud, pl. viii., f. 20).

FIG. 544.—*Helix nitidula* var. β (Drap.), natural size=*Hyalinia radiatula* Alder (after Draparnaud, pl. viii., ff. 21, 22).

Geological Distribution.—One specimen found by Mr. J.W. Jackson in a Neolithic hill-wash at Clapdale, near Clapham, Mid-west Yorkshire.

Geographical Distribution.—In Scotland, Dr. Frew has established its presence in the Island of Iona, Mid Ebudes; while Westernness has also become included among its known habitats by the aid of the government fund, granted to assist us in increasing our knowledge of the northern range of our mollusca.

In Wales, Mr. J. Williams Vaughan has established its occurrence at Velinnewydd, Radnorshire.

In Ireland, Mr. P. H. Grierson has added to its known distribution by its discovery in Longford county.

The known continental range has been increased by its discovery in North Holland by Mr. F. H. Sikes; at Sensburg in East Prussia by Mr. H. Sell; and in Denmark is said by Steenberg to be found everywhere in the woods.

In France, Mr. F. H. Sikes has added Eure, Eure-et-Loire, and Indre-et-Loire to the list of departments where this species is known to occur; and M. Granger has also recorded the Landes, Basses Pyrénées, Gironde, and Charente Inférieure.

In Austro-Hungary, Dr. Reinhardt records it from the Sudeten in Moravia; and F. J. Schmidt from Carniola.

Var. nitens Michaud.

ENGLAND.

Westmorland and Lake Lancashire—Grange, J. Davy Dean.

FRANCE.

Basses Alpes—Recorded by M. Margier as not common in the Upper Valley of the Verdon.

Var. lucens Pult.

ENGLAND.

Lancashire W.—Silverdale, J. Davy Dean.

DENMARK.

Recorded by Steenberg as rare in Zealand and East Jutland.

Var. olearis Westerlund.

DENMARK.

Recorded as rare in North Zealand by Steenberg.

Var. virens-albida Michaud.

IRELAND.

Cavan—In great profusion under beech trees in Derrygid woods, Farnham, near Cavan, July 1911 (Irish Nat., Sept. 1911, p. 163).

SCANDINAVIA.

Denmark—Sub-var. *helmii* recorded as rare by Steenberg from East Jutland, Zealand, and Bornholm.

Hyalinia pura (Alder).

Nomenclature.—Comm. Caziot (Moll. Monaco and Alpes Mar., 1910, p. 42) relying upon Dr. Westerlund that *Hyalinia nitidosa* comprises the *H. pura* Alder and the *H. hammonis* of Ström, has separated the two forms, and superseded the name of *pura* by that of *nitidosa* for the smooth form, and for the radiately sculptured form adopted the name *hammonis* of Ström in preference to *H. radiatula* Alder.

Geological Distribution.—A few specimens found by Mr. J. W. Jackson in a Neolithic hill-wash at Clapdale, Clapham, Mid-west Yorks.

Geographical Distribution.—In Great Britain, the distributional area of this species has been sensibly increased for the typical form, which has been found to inhabit East Cornwall, East Sussex, Middlesex, Salop, Brecon, Flint, Glamorgan, and the Isle of Man, in addition to the comital and vice-comital districts shown on Plate ix.

In Ireland, the type has been found in the additional districts of Cavan, Kildare, King's co., and West Galway.

In France, it is recorded from the Côtes-du-Nord by Mr. F. H. Sikes; by M. Granger from Charente Inférieure, Gironde, the Landes, and Basses Pyrénées.

In Germany, the additional records obtained include Anhalt, Darmstadt, Merseburg, Reuss, Waldeck, and Prussian Silesia.

In Italy, the type form is reported from the Apuan Alps, Tuscany.

In Russia, it is recorded from Moscow by Milachevitch.

In Denmark, it is, according to Dr. Steenberg, very common in most of the beech-woods of the country.

Var. *nitidosa* Férussac.

ENGLAND AND WALES.

This variety is also reported by different observers from East Cornwall, Bucks., Middlesex, Brecon, Radnor and Glamorgan.

IRELAND.

The counties of Carlow and West Galway have been added to the inhabited area of this variety.

FRANCE.

Ardennes—Recorded from the department by Mons. H. Cardot.

NETHERLANDS.

Belgium—Recorded from Hastière, Namur, by Mons. H. Cardot.

SCANDINAVIA.

Denmark—Recorded by Dr. Steenberg as rare on Zealand and in East Jutland.

ITALY.

Sicily—Recorded by Signor Benoit from Madonie.

RUSSIA.

Kharkov—Recorded from the government of Kharkov by Krynicki.

Var. *lenticularis* Held.

SCANDINAVIA.

Denmark—Recorded by Steenberg as rare on the Island of Möen.

Hyalinia radiatula (Alder).

Anatomy.—The figure of the reproductive system of this species (p. 89, f. 123) is by some regrettable oversight labelled *Hyalinia pura*.

Geographical Distribution.—The area occupied by this species in this country has been appreciably increased by the addition of several comital and vice-comital districts.

ENGLAND AND WALES.

- Devon S.—Chagford, June 1911 ! Mrs. Longstaff.
 Hants. S.—Hambledon ! L. Dawes.
 Kent E.—Cobham Woods ! F. H. Sikes.
 Gloucester E.—Elcombe near Stroud, C. Upton.
 Flint—Graig Arthur ! R. Standen and J. Wilfrid Jackson.

SCOTLAND.

- Kincardine—Amongst Great Hairy Woodrush, cliff slopes at Muchalls ! F. Booth.
 Aberdeen N.—Golf-links north of river Ugie ! F. Booth.
 Westernness—Glenbeg Valley and other places ! F. Booth.

NETHERLANDS.

- Holland—Bergen, North Holland ! F. H. Sikes.

SWITZERLAND.

- Basle—Recorded from several districts in the Canton by M. Bollinger.
 Ticino—Recorded as *Zonites striatulus* by the Abbe Stabile from Lugano.

Var. *viridula* Menke.

ENGLAND.

- Devon S.—Chagford, June 1911 ! Mrs. Longstaff.

SCOTLAND.

- Aberdeen S.—Persley Den near Aberdeen ! F. Booth.
 Westernness—Glenelg, rare ! F. Booth.
 Dumbarton—Cardross, J. R. le B. Tomlin.

GERMANY.

- Silesia—Sub-var. *albina*, Wölfelsfall, O. Reinhardt.

FRANCE.

- Gironde—Cited for Arcachon by M. Granger.

Var. *petronella* Charp.

SCANDINAVIA.

- Denmark—Rare on Zealand and Funen (Steenberg, Nachbl. Deutsch. Mal. Ges., 1913, p. 127).

Hyalinia crystallina (Müller).

Geological Distribution.—Recorded as plentiful in the Pleistocene lacustrine deposits, Woodston, Huntingdonshire, by Rev. C. E. Y. Kendall.

In Mid-west Yorkshire, Mr. J. W. Jackson found this species abundant and large in a hill-wash of Neolithic age at Clapdale near Clapham.

The var. *contracta* is recorded by Dr. Böttger from the alluvium of Pleistocene age at Frankfort-on-the-Main, Germany.

Geographical Distribution.—In Scotland, the occurrence of this species in North and South Aberdeen has been verified by Mr. F. Booth.

In Holland it was found by Mr. F. H. Sikes at Heerenveen, Friesland.

In France it has been collected by Mr. F. H. Sikes from the rejectamenta of the river Indre, at Glion, in the department of the Indre; M. Berenguier records it from the Var; and M. Granger from Charente Inférieure, Gironde, Landes, and Basses Pyrénées.

In Switzerland, M. Bollinger records it from many places in the Canton of Basle.

In the Balkan Peninsula, M. Bollinger also quotes it as inhabiting Roumania, Bosnia, and Dalmatia.

In Russia, it is, according to M. Bollinger, recorded by Dr. Böttger from the Caucasus under the name of *H. pygmaea*.

In Denmark, Dr. Steenberg records it as common throughout the country.

In South Africa, Major Connolly records it as plentiful at Cape Town and its suburbs.

Var. *subterranea* Bourg.

SCANDINAVIA.

Denmark—Rare (Steenberg, Nachbl. Deutsch. Mal. Ges., 1913, p. 126).

Var. *contracta* Westerlund.

SCANDINAVIA.

Denmark—Rare (Steenberg, Nachbl. Deutsch. Mal. Ges., 1913, p. 126).

SUB-GENUS *Euconulus* Reinhardt.

***Hyalinia fulva* (Müller).**

Nomenclature and Shell Characters.—M. Bollinger has studied and described the spiral sculpture at the base of the shell of this species, figuring the relative degrees of closeness, and remarking that the closely lineate shells are generally pale in colour, while those with more widely-spaced linear groovings are of a darker shade. Three other modifications of this revolving sculpture are mentioned, one of which shows groupings of five crowded lines separated by two widely separated ones.

Habits.—This species is, according to the observations of Mr. Stelfox, one of the few species which in Ireland inhabit the vicinity of the peat-bogs.

Geological Distribution.—Mr. T. Sheppard has recorded this species from a dark lacustrine marl, probably of Pleistocene age, at Bealsbeck, near Market Weighton, South-east Yorkshire.

HOLOCENE.—Found in molehill, at Wilstone, Herts. ! C. Oldham; and according to Mr. J. W. Jackson is common in a hill-wash of probably Neolithic age at Clapdale near Clapham, Mid-west Yorkshire.

In Ireland, it has been found in the deposits at Horn Head, near Tramore, co. Donegal.

In Denmark, Dr. Steenberg records it from the fresh-water limestone in the submerged marsh at Frihavnen.

Geographical Distribution.—The true *H. fulva*, according to Dr. Pilsbry, runs down the Rocky Mountains, at least as far as Mexico, at elevations of about 4,000 feet.

In Holland, it has been found at Heerenveen, Friesland, and at Bergen, North Holland, by Mr. F. H. Sikes.

In France, M. Margier records it for the Verdon Valley, Basses Alpes; M. Berenguier for the Var; M. Granger for Charente Inférieure, Gironde, Landes, and Basses Pyrénées. The form *callopectica* is recorded as rare in the Alpes Maritimes by Comm. Caziot, and M. Berenguier cites it from the Var.

In Denmark, Dr. Steenberg says it is common in all beechwoods.

Var. *mortonii* Jeffreys.

IRELAND.

Galway E.—Kilbeg, Sept. 1907, A. W. Stelfox.

FRANCE.

Alpes Maritimes—Reported rather common in the department by Comm. Caziot.

Var.—Cited for the department by M. Berenguier.

SCANDINAVIA.

Denmark—Recorded by Dr. Steenberg as a native of that country.

Var. *alderi* Gray.

NETHERLANDS.

Holland—Heerenveen, Friesland, Aug. 1909 ! F. H. Sikes.

SCANDINAVIA.

Denmark—Var. *alderi* and sub-v. *praticola* recorded for Denmark by Steenberg.Var. *alaskensis* Pilsbry.

NEARCTIC REGION.

United States—Recorded by Prof. T. D. A. Cockerell from an altitude of 9,000 feet at Tolland, Gilpin co., Colorado.

Var. *viridula* Taylor.

ENGLAND.

Gloucester W.—Very pale almost white specimens in Long Wood, Frocester ! C. Upton.

GENUS *ZONITOIDES* Lehmann.*Zonitoides excavatus* (Bean).

By oversight the formal description of this species was omitted in its proper place ; I therefore give it here.

Description—SHELL depressed, but more convex above than beneath ; thin, semi-transparent, and glossy ; of a dark-fawn or fulvous-horn colour, with strong and somewhat irregular striae in the line of growth, which are fainter beneath, where the shell is also of a paler and yellower tint ; WHORLS five, slowly and very regularly increasing in size, convex, and almost cylindrical in shape ; SUTURE deeply and distinctly impressed ; SPIRE slightly risen ; UMBILICUS widely and perspective open, exposing all the internal spire ; APERTURE small and somewhat oblique, margins thin, not reflected, and slightly approximating.

Diameter 6-7 mill. ; altitude 3 mill.

In crawling, the animal often carries the shell well elevated, and imparts to it a "rolling" motion from side to side.

Geographical Distribution.—The known area of distribution of this species has been materially increased since the publication of Part xv., not only by the laudable activity of conchologists, but by the privilege of access to previously unexamined literature.

ENGLAND AND WALES.

Devon S.—Erme Woods, Ivybridge, E. D. Marquand.

Somerset S.—Dulverton, 1903 ! Hugh Watson.

Somerset N.—Pylle (Townsend) ; under loose stones outside Worlebury Camp, Weston-super-Mare, F. A. Knight. Weston Wood, E. W. Swanton.

Berks.—Bucklersbury, Sept. 1906 ! Rev. E. Peake.

Carnarvon—Carn Bodfean near Nevin, 1901, H. C. Napier.

Brecon—Clydach Falls, April 1909 ! F. H. Sikes.

Cardigan—Devil's Bridge, July 1909 ! B. R. Lucas.

Lincoln N.—Woodhall Spa, F. W. Fierke. Tumby Wood ! W. Denison Roebuck.

SCOTLAND.

Dumfries—Specimens labelled “Dumfriesshire”! in the Rimmer Collection, Edinburgh Museum.

Lanark—Bishopbriggs, A. Frew.

Kincardine—Found in Seaton Park by Prof. Macgillivray.

Westernness—Glenbeg Valley, Aug. 1910 ! F. Booth.

IRELAND.

Derry—Walworth Woods, abundant, July 1903 ! J. N. Milne.

Down—Has been recorded for co. Down, but not confirmed of recent years.

Monaghan—Mr. Stelfox says “recorded by error in the Conchological Society’s Census for 1902.”

Tyrone—Baron’s Court near Newtownstewart, July 1911 (Irish Nat., Sept. 1911, p. 161).

NETHERLANDS.

Holland—Mr. J. R. le B. Tomlin reports it as found at Rhoon near Rotterdam.

SCANDINAVIA.

Denmark—Quite common in Jutland and on the islands (Steenberg, Nachbl. Deutsch Mal. Ges., 1913, p. 137).

Var. *vitrina* Jeffreys.

This variety in Ireland is usually equally prevalent with the type form, though generally living in separate colonies, but in the south-east of Ireland, according to Mr. Phillips, it is the ordinary form, the usual type being apparently quite absent.

The known distribution of this variety has been increased, especially in Ireland, where the labours of Mr. Bell, Mr. Grierson, and Mr. Phillips have resulted in adding the counties of Clare, Kilkenny, Tyrone and Wexford.

In Scotland, Mr. J. F. Musham has added Wigtownshire, having found specimens at Stranraer, in Aug. 1909 ! ; while Mr. J. R. le B. Tomlin found a pale coloured form at Cardross in Dumbartonshire.

Zonitoides nitidus Müller.

Geological Distribution.—Recorded by Mons. A. Laville from the Holocene gravel beds, Joinville-le-Pont, department of the Seine.

Geographical Distribution.—In Scotland, West Ross was added to the known range of this species in the course of the investigations into the northern range of the extra-marine mollusca undertaken by government aid.

In Wales, it has been found by Mr. F. H. Sikes at Llanbedr, Merioneth.

In Ireland, its range has been increased by its discovery in Armagh by the members of the Belfast Field Club.

On the continent Mr. F. H. Sikes has collected this species in Holland at Bergen in North Holland, and Heerenveen, Friesland.

In France he has also established its occurrence in the departments of the Indre and Indre-et-Loire, and at Léhou and Dinan, Côtes-du-Nord ; while Payot records it for Haute Savoie ; M. Berenguier from the Var ; and M. Granger from Charente Inférieure, Gironde, Landes, and Basses Pyrénées.

In Germany, Anhalt, Brunswick, Magdeburg, and Saxony have been added to the list of inhabited districts.

In Italy it has been recorded for Campania, Liguria, and Venetia, by Pirona and others.

In the Balkan peninsula, Dr. Sturany records it from Montenegro, and Möllendorff from Bosnia.

In Switzerland, M. Bollinger records it from many places in the Canton of Basle.

In Denmark, it is said to be common throughout the country (Steenberg, Nachbl. Deutsch. Mal. Ges., 1913, p. 127).

In Russia, it is reported by Mr. H. Sell, of Copenhagen, from Lithuania, an ancient Russian province, now mostly comprised in the governments of Grodno, Minsk, Mohilev, Vilna, Vitebsk, and the East Prussian province of Gumbinnen.

FAMILY ENDODONTIDÆ Pilsbry.

SUB-FAMILY POLYPLACOGNATHA Pilsbry.

GENUS *PUNCTUM* Morse.

***Punctum pygmæum* (Drap.).**

Geological Distribution.—Abundant in the Pleistocene lacustrine deposits in the vicinity of Woodston, Huntingdonshire, and recorded by Rev. C. E. Y. Kendall.

In France, it is recorded by Nevill from the fossil beds of Mentone in the Alpes Maritimes.

Geographical Distribution.—Our knowledge of the general and northern range of this species has been materially increased by the results of the investigations of the subject by several earnest workers.

ENGLAND AND WALES.

Somerset N.—Uncommon at Wincanton and Bratton St. Maur ! E. W. Swanton.

Bedford—Bedford, Oct. 1911 ! E. D. Marquand.

Norfolk W.—Common at Garboldisham, Aug. 1890, L. E. Adams.

Hereford—Near Symond's Yat, April 1909 ! F. H. Sikes.

Worcester—Earl's Croome ! N. G. Hadden.

Carmarthen—In moss by roadside nr. Talley Abbey, June 1911 ! J. W. Vaughan.

Carnarvon—A few in Talybont Marsh, April 1905 ! F. Taylor.

Cheviotland—In moss on the sandhills at Alnmouth ! A. M. Oliver.

SCOTLAND.

Dumfries—Annan, Capt. W. J. Farrer.

Lanark—Specimens in the Kelvingrove Museum, Glasgow, collected by Mr. D. Robertson, at Hairmyres, Sept. 1872 !

Perth Mid—Drummond Hill, April 1892 ! W. Evans.

Aberdeen S.—Scarce in Persley Glen, Aug. 1910 ! F. Booth.

Banff—Banks of Avon above Ballindalloch, Aug. 1891 ! W. Evans.

Elgin—Ballindalloch Castle, Aug. 1891 ! W. Evans.

Westernness—Common in most places on the cliffs south of Beithe, also found in Glenbeg and other places, Aug. 1910 ! F. Booth.

Ebudes N.—At Broadford and other places in the Isle of Skye, on Great Hairy Woodrush, etc., Aug. 1910 ! F. Booth.

IRELAND.

Cavan—Shercock, 1906 ! P. H. Grierson.

Kildare—Coolcarrigan, July 1907 ! A. W. Stelfox.

King's Co.—Recorded for this county by Mr. Stelfox.

Roscommon—Recorded by Mr. Adams as found by Mr. Grierson in April 1903.

Limerick—Recorded from the county by Mr. Stelfox.

In France, Mr. F. H. Sikes has added the department of the Vosges to its area of distribution, having found specimens at Nidachthal, Sept. 1911 ! M. Granger gives it as inhabiting Charente Inférieure, Landes, Gironde, and Basses Pyrénées, and Dr. Germain records it as rare from Angers and other localities in Maine-et-Loire.

In Switzerland, M. Bollinger records it from numerous localities in the Canton Basle, and remarks on its reaching an altitude approaching to 6,000 feet at Mürren in Canton Berne.

In Denmark, Steenberg says it is common in the beech-woods.

SUB-FAMILY HAPLOGONA Pilsbry.

GENUS *PYRAMIDULA* Fitzinger.

***Pyramidula rupestris* (Drap.).**

Classification and Affinities.—The Rev. E. W. W. Howell hazards the opinion that this species should be placed in *Helicigona* with *H. arbutorum* and *H. lapicida*, incorrectly stating that the radula is an almost exact copy of that of *H. lapicida* and has not the slightest resemblance to that of *Pyramidula rotundata*.

The *Helix* (*Patula*) *jaensis* of Clessin (Malak. Blatt., vol. v., p. 187, pl. iv., f. 3) described as from Jaen, Andalusia, is said to be probably a variety of this species by the editor of the Zoological Record for 1882.

Geological Distribution.—Recorded from the English Holocene deposits at Erith, West Kent, by M. Dollfuss ; and by M. Cardot from the “sables” of Wasigny, Ardennes, France.

Geographical Distribution.—In France, this species is recorded by M. Berenguier from the department of the Var ; by M. Granger from the Gironde, Charente Inférieure, Landes, and Basses Pyrénées, and by Dr. Paul Germain from Maine-et-Loire.

In Switzerland, Mr. Hugh Watson has added to its known localities the canton of Unterwalden, having found specimens at Stansstad near Lucerne, in 1904 ; M. Bollinger reports it as common in various localities in Canton Basle ; and I have myself found it in Canton Schaffhausen.

Var. *umbilicata* Mont.

SWITZERLAND.

Ticino—Sub-var. *saxatilis* cited for Lugano by the Abbe Stabile.

SPAIN.

Catalonia—Sub-var. *saxatilis* cited by Bofil-y-Poch.

Var. *conoidea* Bourg.

SWITZERLAND.

Ticino—Sub-var. *rupicola* cited for Lugano by the Abbe Stabile.

Var. *viridescenti-alba* Jeffreys.

IRELAND.

Galway E.—Kilbeg ! C. E. Wright.

SUB-GENUS *Discus* Fitzinger.**Pyramidula rotundata** (Müller).

Classification and Affinities.—Rev. E. W. W. Bowell has expressed the opinion that *P. rotundata* is easily distinguished by its radula from other *Helicids*, and that it is apparently an earlier form uniting certain features, as the tendency to multicuspid marginals especially in young specimens, is reminiscent of the *Pupidae*, but with a general facies of the group, embracing *virgata*, *cantiana*, *granulata*, *hispida*, *rufescens*, *revelata*, etc., and adds that *P. rotundata* may perhaps be added to the group of *Helices* distinguished by an *Arionid* radula.

The *Helix omalisma* of Bourguignat is, according to M. Granger, merely a very depressed form of *Pyramidula rotundata* found on the mountains around St. Jean de Luz, Basses Pyrénées, France.

Enemies.—It is one of the species preyed upon by the Stockdove, Mr. C. E. Wright stating that 162 specimens have been found in the crop of a single bird at Frodingham, Lincolnshire.

It is rare at Thrush-stones in the same county, according to the Rev. E. Adrian Woodruffe-Peacock.

Geological Distribution.—Found abundantly in the Pleistocene lacustrine deposits at Woodston, Huntingdonshire, by Rev. C. E. Y. Kendall.

HOLOCENE.—In Bucks., it has been found in the alluvial brick-earth and in the superimposed deposits at Boveney by Mr. J. E. Cooper.

In North Lincoln, it has been found at Greetwell by Mr. J. F. Musham.

In South-east Yorkshire, the Rev. E. P. Blackburn records the finding of specimens by Mr. Mortimer in "barrows" of the Bronze age, and from the grave and body of a prehistoric mound in Willie Howe's plantation near Sledmere. In Mid-west Yorkshire, Mr. J. W. Jackson found it abundantly in a hill-wash of probably Neolithic age in Clapdale near Clapham.

Geographical Distribution.—Mr. F. H. Sikes has added a province in Holland to the known habitats of this species, having found specimens at Texel, Friesland, in Aug. 1909.

In France, M. Berenguier includes this in his list of *Helices* found in the department of the Var.

In Denmark, it is described by Dr. Steenberg as very plentiful.

Var. **turtonii** Fleming.

ENGLAND.

York Mid W.—Grimbald's Crag, Knaresborough, May 1909 ! W. E. Brady.

York N.E.—Cayton Bay and Carnelian Bay, Scarborough, Sep. 1909 ! W. E. Brady.

FRANCE.

Indre-et-Loire—Forest of Loches, April 1912 ! F. H. Sikes.

Var. **scalaris** Fér.

ENGLAND.

Herts.—Aldbury, June 1909 ! C. Oldham.

Northampton—Sub-vars. *pyramidalis* and *subscalaris*, Haselbeech, May and Oct. 1904, Rev. W. A. Shaw.

AUSTRO-HUNGARY.

Carinthia—Dr. von Gallenstein records "highly-wound" shells as somewhat common in the "Garten des Schlosses Maria Loretto am Worthersee."

Var. **alba** Moquin-Tandon.

SWITZERLAND.

Ticino—One specimen found by Abbe Stabile at Castagnola.

SCANDINAVIA.

Denmark—Not rare (Steenberg, Nachrb. Deutsch. Mal. Ges., 1913, p. 128).

Var. **rufula** Moquin-Tandon.

WALES.

Flint—Quarries behind Prestatyn with the type form (Standen and Jackson, Lancashire Naturalist, Dec. 1913, p. 352).

FRANCE.

Maine-et-Loire—Rather common about Angers according to Dr. Germain.

Pyramidula rudrata (Studer).

Geological Distribution.—This species is said to have been found in the Forest-Bed, which is regarded as late Pliocene or early Pleistocene, according to individual bias.

PLEISTOCENE.—Abundant and fine in the alluvial deposits at Woodston, Huntingdonshire, where it has been found by the Rev. C. E. Y. Kendall.

In Lancashire Mid, several found amongst the cave-earth in the Dog-Holes Caves, Warton Crag, near Carnforth, by Mr. J. Wilfrid Jackson.

In Germany, Dr. Böttger records it from alluvium at Frankfort-on-the-Main.

FAMILY HELICIDÆ Linné.

SUB-FAMILY BELOGONA Pilsbry.

GROUP *BELOGONA SIPHONADENIA* Pilsbry.GENUS *HELIX* Linné.**Helix pomatia** Linné.

Classification.—The Rev. E. W. W. Bowell from a careful study of the radula concludes that *Helix pomatia*, *H. aspersa*, *H. nemoralis*, *H. hortensis* and *H. pisana* constitute a well defined, striking, and homogeneous group, easily separable from other sections, though each shows distinctive features of minor importance.

Parasites.—An active yellow mite was observed on this species by Prof. C. Semper, but unfortunately not identified or studied.

The Bee *Osmia helicicola*, according to Johnston, usually makes use of the empty shells of this species as a site for its nest, while another insect, *Sapyga punctata*, occupies the same shell and passes through two of the stages of its existence within the cells of the *Osmia*.

Geographical Distribution.—Little advance has been made in our knowledge of the range of this species; the shell is so very large and conspicuous that its presence in any district cannot readily be overlooked by the observer.

In Northamptonshire, the knowledge of its presence, which was previously in a large measure historical, has been investigated by Mr. C. E. Wright, of Kettering, who reports it as numerous in a rose coppice at Denford, Aug. 1900; a good colony in disused stone quarry at Slipton, June 1907; a thriving colony in all stages of growth found in hedgerows near Sudborough in 1907; on railway bank, Ringstead; near old quarry, Rockingham Park; and numerous feeding in the hedgerows at Woodford.

Though generally distributed throughout Eastern and South-eastern France, it does not yet naturally exist, according to M. Granger, to the south of the river Garonne, and is quite rare in the department of Charente-Inférieure. It is also recorded by Dr. Germain as very common in many localities on the elevated limestone plateau in Maine-et-Loire.

In Croatia, it is recorded as *Pomatia antiquorum* Leach from many localities by Prof. Spiridon Brusina.

In Roumania, Dr. Kobelt has recorded receiving specimens from Dr. Heynemann from several localities near Bucharest.

In Denmark, Dr. Steenberg says it is common near the cities and in convent gardens in East Jutland, and also on the larger islands.

Variation.—In addition to the varieties treated upon or enumerated in Parts xvi. and xvii., others of more or less interest and importance have since been added or have come to my knowledge.

Light is thrown on the variation of this species by the researches of Dr. Otto Büchner, who has devoted special attention and study to the forms it assumes, and has published two special treatises thereon in which he accurately figures many of the varieties. Several of his illustrations are, therefore, reproduced here for the guidance of those to whom the original work may not be readily accessible.

Amongst other interesting or rare forms which he figures and describes are the vars. *inflata* and *sphaeralis* of Hartmann; the vars. *turrita* and *grandis* of authors, etc.

He also brings forward as novelties, or as forms requiring distinctive names, the vars. *normalis*, *plagiostoma*, *parva*, *vulgaris*, *albescens*, and *diaphana*.

The var. *detrita* of Dr. Koenig von Warthausen is a large woodland form, fifty to fifty-six millimetres in diameter, and characterised by a very perishable and caducous epidermis, which he has found frequenting the open deciduous woods with little undergrowth about Tübingen, Ulm, Stuttgart, and elsewhere in Wurtemberg.

Mr. A. G. Stubbs has observed that at Gallow's Hill, Hertfordshire, the darker specimens are found in the more shaded localities, and that when the animals live in the more open and exposed places the shells tend to become bleached by the sun.

Occasionally the aperture may in this species become restricted by the formation of a septum, due to the winter epiphragm not being entirely thrown off and the vestige remaining adherent to the shell becoming overlaid by a shelly deposit. A specimen showing this phenomenon was found by Mr. H. C. Higgins at Charing, Kent, in 1909.

Dr. von Gallenstein also alludes to a var. *laevrosa*, not yet found in Carinthia, but of which he gives no description.

Var. *depressa* Taylor.

The var. *depressa* is based on the figures of Dr. Büchner, which are from the photographs of the actual shells, from Wurtemberg, and show a very depressed and openly umbilicated form, 48 mill. in diam., and 37 mill. in altitude.

M. Bollinger regards the *H. rustica* Hartmann as closely related to this variety, describing it as flatly coiled, thin shelled, and openly umbilicated, but this view is not borne out by Hartmann's text or by the figures which represent the normal form of the species.



FIG. 545.—*Helix pomatia* var. *depressa* Taylor. Wurtemberg (after Büchner).



FIG. 546.—*Helix pomatia* v. *plagiostoma* Buchner. Wurtemberg (after Büchner).

Var. *gesneri* Hartmann.

The sub-var. *plagiostoma* of Büchner, which as a subsidiary form of var. *gesneri* was described on p. 222 of the present volume, belongs to the conoidal section, in which the spire is more produced and the mouth diminished in size.

GERMANY.

Wurtemberg—The sub-var. *plagiostoma* is quoted by Büchner from Neuhausen, Berg, Münster, Warthausen, Esslingen, Gaildorf, and Hofen on the Neckar.

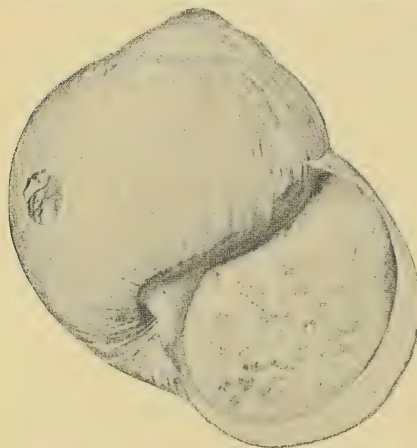


FIG. 547.—*Helix pomatia* var. *inflata* Hartm. Wurtemberg. This figure also represents the var. *detrita* of von Warthausen (after Büchner).

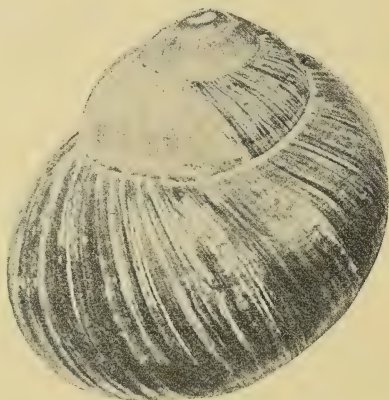


FIG. 548.—*Helix pomatia* sub-var. *sphaeralis* Hartmann. Wurtemberg (after Büchner).

Var. *inflata* Hartmann.

This variety, which was described on p. 223 of the present volume, and is representative of the swollen or globose form this species assumes, includes also the var. *sphaeralis* of the same author.

Dr. Otto Büchner, who has made a special study of, and published treatises exclusively dealing with *Helix pomatia*, has figured what he regards as representative examples of both these forms, which are reproduced here as indicating his views as to the precise identity of the different varieties.

The sub-var. *sphaeratis* being described as an extremely globose though not as a large shell, the specimen now figured must represent a major form of this sub-variety.

GERMANY.

Wurtemberg—The var. *inflata* is quoted by Dr. Büchner for Schussenried, Stuttgart, Warthausen, and Neuhausen-am-Fildern, and the sub-var. *sphaeratis* is recorded by him for Uhingen, Warthausen, and Biberach.

Var. *turrita* Büchner.

The var. *turrita* is described as very variable in size, with a strikingly elongated spire, and mostly thick shelled, especially in the larger specimens; the ground colour is usually pale, and the umbilicus more or less covered or concealed.

The specimen figured and described as m. *turritum* on p. 228, pl. xxi., was abnormal, as there stated, but the figure and description of Dr. Büchner indicate a regularly coiled though elongate spire.

Wurtemberg—The figure of the type given by Büchner is reproduced. This form is described as having been found at Stuttgart, Solitude near Stuttgart, and Neckarthailfingen.

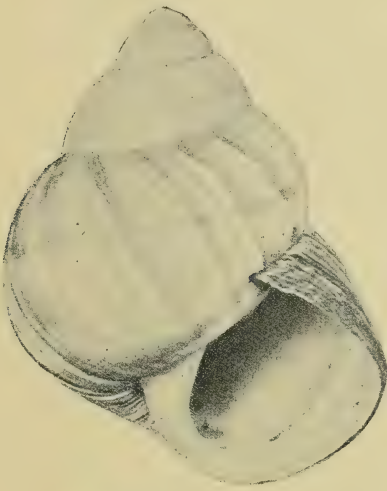


FIG. 549.—*Helix pomatia* var. *turrita*
Büchner. Wurtemberg (after Büchner).

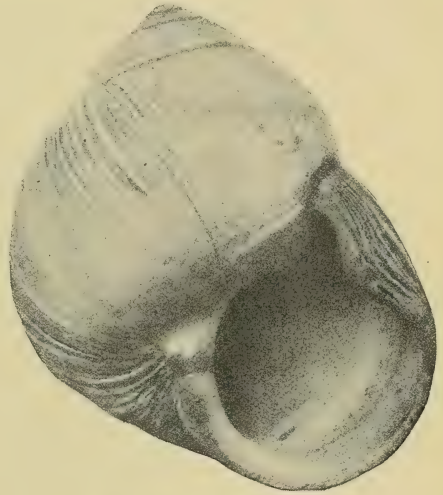


FIG. 550.—*Helix pomatia* var. *ponderosa*
Baudon. Wurtemberg (after fig. by Büchner).

Var. *ponderosa* Baudon.

Dr. Büchner, though figuring this characteristic specimen of var. *ponderosa*, does not allude to it under that name, as, having regard only to its form, he considers it as an intermediate state between the vars. *sphaeratis* and *turrita*.

GERMANY.

Wurtemberg—Specimens of great solidity and thickness referable to this variety are recorded by Dr. Büchner.

Var. *tenuis* Baudon.

Helix pomatia var. *diaphana* Büchner, on *H. pomatia*, 1899, p. 227.

The sub-var. **diaphana** is described by Dr. Büchner as of medium size, thin, and translucent, lip of a deep flesh-colour, which sometimes verges upon violet; periostracum dark brown, very glossy, and somewhat unicolorous.

Dr. Büchner regards this shell as analogous to *Helicigona arbustorum* var. *picea* Zgl. and *Helix hortensis* var. *pellucida* Clessin.

GERMANY.

Wurtemberg—It inhabits deciduous woods on the Keuper formation or other soils deficient of lime about Buoch.

AUSTRO-HUNGARY.

Transylvania—Thin and bandless shells, probably this variety, are recorded by Bielz from Ober-Tömösch and from the foot of the Gotzenbergs.

Var. *gigantea* Porro.**ENGLAND.**

Surrey—The largest British shells of which I have knowledge were found by Mr. A. G. Stubbs on a chalky bank at Warlingham near Croydon.

GERMANY.

Wurtemberg—The sub-var. *grandis* is recorded by Büchner and his figure is reproduced here.

The author cites Dapfen, Kapfenburg, Tutlingen, and Kirchheim in the Forchenwald as localities.

FRANCE.

Eure—The sub-var. *compacta* in beech wood, Evreux, April 1912 ! F. H. Sikes.

AUSTRO-HUNGARY.

Transylvania—Large specimens about 58 mill. in diameter and 50 mill. in altitude are mentioned by Bielz as found in Hätzeger Thal, and at Csáki-Gorbo.



FIG. 551.—*Helix pomatia* sub-var. *grandis* Moq. Wurtemberg (after Büchner).

Var. *parva* Porro.

Helix pomatia f. *parva* Büchner on *H. pomatia*, 1899, p. 277 and figs.

The var. *parva* of Büchner is a still more stunted form than that of Porro.

GERMANY.

Wurtemberg—The var. *parva* of Büchner is also recorded and figured by that author from Stuttgart, the specimens being almost identical with those from Klagenfurt. He also cites it from Ludwigsburg, Neuhausen, Warthausen, and Ravensburg.

FRANCE.

Seine Inférieure—Recorded by M. Fortin as rather rare in the department.

AUSTRO-HUNGARY.

Transylvania—Dr. Bielz remarks on some very small specimens found in the vicinity of Herrmannstadt, which are probably referable to this variety.

Carinthia—The var. *parva* of Büchner, now figured, is from the collection of Dr. Koenig von Warthausen, and is from Klagenfurt.



FIG. 552.—*H. pomatia* v. *parva* Büchner. Klagenfurt, Carinthia (after Büchner).

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Var. **brunnea** Moquin-Tandon (see p. 227).

ITALY.

Venetia—The sub-var. *piceata* is recorded by Büchner from Tarbole, Lake Garda.

Var. **albida** Moquin-Tandon (see p. 226).

Helix pomatia f. *albescens* Buchner on *H. pomatia*, 1899, p. 237.

Dr. Büchner suggests the use of the name *albescens* as more correctly applicable to the shells of this variety than those of *albina*, *alba*, etc., which are usually employed.

GERMANY.

Wurtemberg—The sub-var. *albescens* is cited by Dr. Büchner from Münster and Laffan on the Neckar; Mohringen and Neuhausen on the Fildern; and also about Neckarthailfingen, Urach, and several other localities.

Var. **pseudoligata** Paulucci, Faun. Mal. Italie, 1878, p. 35.

This variety is described as resembling *Helix ligata* Müll., but, chiefly on the somewhat slender foundation that its habitat lies beyond and outside that of the true *H. ligata* it is regarded by the authoress as a variety of *H. pomatia*.

It is the antithesis of *H. ligata* var. *pseudopomatia* of Blanc, which has all the characters of *H. pomatia* and would be referred to that species but that the habitat on Monte Corno, Abruzzi, is beyond its natural range.

ITALY.

Emilia—The *H. pomatia* var. *pseudoligata* was found in the vicinity of Fiorenzuola d'Arda, in the province of Piacenza (Paulucci, l.c.).

Monst. **sinistrorsum** Moquin-Tandon (see p. 228).

This reversal of the normal mode of coiling in *Helix pomatia* is probably fairly common where the species is abundant.

ENGLAND.

Norfolk W.—One specimen from an ivy-grown wall, Heacham, 1907, W. Royal-Dawson.

GERMANY.

Suabia—Dr. Otto Büchner records fourteen examples known to him from the snail farms at Ulm, Dapfen, Sigmaringen, and Lauterthal.

Wurtemberg—Dr. Büchner also enumerates four others from Tübingen, Ravensburg, Münster on the Neckar, and Mohringen on the Fildern.

Nassau—Prof. Sandberger records it from Weilburg and Koch from Dillenburg.

AUSTRO-HUNGARY.

Transylvania—Dr. Bielz chronicles a specimen found at Grossau near Hermannstadt.

SWITZERLAND.

Ticino—Abbe Stabile records the finding of a specimen at Vezia, near Lugano.

Monst. **scalare** Müller (see p. 228).

GERMANY.

Wurtemberg—Dr. Büchner records specimens from Tübingen, Stuttgart, and from several snail-farms in Sigmaringen.

AUSTRO-HUNGARY.

Carniola—Dr. F. J. Schmidt has recorded the finding in 1846 of a specimen in a garden in Laibach.

Transylvania—Bielz notes a very fine example collected at Reps.

SUB-GENUS *Cryptomphalus* Agassiz.

Helix aspersa is regarded by Caziot and Fagot as typical of the group *Aspersiana*, which they affirm originated in the African region, and as afterwards spreading into the Iberian peninsula and the Alpine regions.

Dr. R. F. Scharff apparently regards the Mediterranean region as the theatre of the evolution of *Helix aspersa*, while on the other hand Dr. Kobelt believes it arose in the north.

Helix aspersa Müller (see p. 236).

Synonymy.—L. Brumati records as *Helix grisea* L. specimens of *H. aspersa* found at Monfalcone, Goritz, Austro-Hungary.

Geological Distribution.—Comm. Caziot reports it as present in the post-tertiary deposits of the Alpes Maritimes.

Variation.—The *Helix aspersa* from Grand Kabylie are more elongate, rugose, and deeper coloured than those from other parts of Algeria or Tunis; the specimens resemble the *Helix mazzulii* of Sicily, and are evidently an earlier form retreating before the more obliquely globose northern race.

Var. solidissima Paulucci (see p. 257).

Helix aspersa var. *chottica* Pallary, Comptes Rendus, 1900, p. 734, pl. xi., . 3.

The sub-var. *chottica* is described as being characterized by its small size, very globose form, and especially by its thick SHELL; the MOUTH is described as more circular than that of any other variety. It would seem to have its most intimate relationship with the var. *solidissima*.

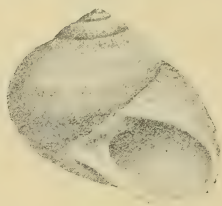


FIG. 553.—*Helix aspersa* v. *chottica* Pallary. Algeria (after Pallary).

NORTH AFRICA.

Algeria—Found by Dr. Séguin at Ain-Sfissifa, south of Chott-el-Chergui, Algeria (Pallary, Comptes Rendus, 1900, p. 734, pl. xi., f. 3).

Var. conoidea Moquin-Tandon (see p. 253).

Helix aspersa v. *antiqua* Caziot & Maury, Mém. Soc. Zool. Fr., vol. xxv., p. 45, pl. i., f. 1, 1912.

The sub-var. *antiqua* is described as conically elevated, with much less globose body-whorl than in the type form, and a much smaller and more oblique aperture, which is much higher than broad. The whole shell has much analogy with *Helix pyrgia* Bourguignat.

FRANCE.

The var. *conoidea* is relatively common about Aix, Bouches-du-Rhône; found also at Angers, Maine-et-Loire; and a conical variety occurs at Col-de-Brouis and at Berre, Alpes Maritimes.

The sub-var. *antiqua* is found fossilized in the Pleistocene sandy-clays of Mont-alban, near Nice, associated with marine shells derived from the Upper Pliocene.

Var. exalbida Moquin-Tandon (see p. 259).

Helix aspersa var. *albescens* Germain, Moll. Angers, 1903, p. 84.

Classification and Affinities.—Dr. Germain describes his var. *albescens* as whitish or yellowish without fasciation, and it is, therefore, properly classified with the var. *exalbida* and is not identical with the var. *albescens* of Picard and Moquin-Tandon, as implied by Dr. Germain, which is described as whitish with reddish fasciæ or flammulations, and, therefore, more properly belonging to the fasciate group.

Dr. Germain states that his variety was found in Maine-et-Loire by Terver, but only on calcareous ground, and mentions Aubigné, Louerre, and by the lime-kilns about Angers as localities.

Var. **fasciata** Picard (see p. 263).*Helix aspersa* var. *albina-fasciata* Germain, Moll. Angers, 1903, p. 84.*Helix aspersa* var. *fasciata* Germain, op. cit., p. 84.*Helix aspersa* var. *coalita* Germain, op. cit., p. 85.

The sub-var. **fasciata** Germain is described as having a grey, brown or blackish ground colour, sometimes maculate with yellow, with 1-5 yellowish, fawn coloured, or blackish bands.

The sub-var. **albina-fasciata** is described as whitish or yellowish, ornate with 1-5 pale grey, brown, or blackish bands, the five-banded specimens usually having the third and fourth bands coalesced.

The sub-var. **coalita** Germain is described as brown or blackish, sometimes maculate with yellow, with 1-5 bands, which are variously coalesced, the bands 3 and 4, or 3, 4, and 5, being most frequently united, the first and second bands more rarely.

FRANCE.

Maine-et-Loire—Sub-var. *albina-fasciata* is uncommon about Angers, and only found on calcareous ground. Sub-var. *fasciata* Germain is rather common about lime-kilns, etc., Angers, and in vine-yards at Briollay. Sub-var. *coalita* is very common everywhere about Angers.

Var. **nigrescens** Moquin-Tandon (see p. 262).*Helix aspersa* var. *concolor* Germain, Moll. Angers, 1903, p. 84.

Synonymy.—Dr. Germain describes as common about Angers a var. *concolor* characterized by a brown or blackish shell, without bands or maculations, which he evidently regards as synonymous with and combining together Moquin-Tandon's vars. *nigrescens* and *unicolor*.

Var. **glabra** Calcar (see p. 259).

ENGLAND.

Lincoln N.—This variety, previously known only from Sicily, has been found to inhabit the churchyard at Rand, near Wragby, by Mr. J. F. Musham.

Monst. **sinistrum** Férussac (see p. 267).

ENGLAND.

Cornwall W.—Roadside between Newquay and Porth, June 1908! T. H. Cribb.

Kent E.—A dead specimen picked up at Kearsney, near Dover, H. C. Huggins.

SUB-GENUS *Cepœa* Held (see p. 274).

This group, according to Comm. Caziot, arose in the Taurian region, and has spread therefrom, dwindling in size in the Alpine region, and disappearing in the Lusitanian or Spanish region.

Dr. L. Germain, on the other hand, acquiesces in the opinion of M. Bourguignat, that the group originated in Central Asia, *Helix atrolabiata* Kryn. being regarded as probably the ancestral form, or most closely related thereto, spreading westward into Europe by the Danubian valley, evolving in its course *Helix stauropolitana* now inhabiting the Caucasian region, from which arose *Helix depereta* Loc. (a shell of large size, from the tufa beds of Baume-d'Hostun, Isère, which recalls the *H. atrolabiata*), and the Central European *Helix austriaca*, the latter originating *Helix nemoralis* var. *subaustriaca* and the south-westerly *Helix sylvatica*. The *Helix depereta* is assumed to have been the immediate ancestor of *Helix hortensis*, which is erroneously considered to be the latest evolved member of the group, while *Helix nemoralis* is affirmed to be jointly originated by *Helix depereta* and *Helix subaustriaca*.

These various surmises as to the location of the evolutionary region are, however, all open to the objection that they are based upon the erroneous assumption that the area of development or original home of a primitive species is always within the area where it exists at the present day, quite disregarding the acknowledged facts that new species arise because the differences they acquire confer some advantage over the older forms from which they have emanated, and that these improved descendants eventually displace the ancestral forms.

A survey of the facts given by Dr. Germain shows them to be in perfect harmony with the principles of distribution propounded in the present work, which are based on the comparative anatomy and the probable phylogenetic history of the organisms.

Helix nemoralis Linné (see p. 274).

Physiology and Food.—Mr. R. Welch has remarked on the comparatively small amount of food consumed by this species in confinement, a circumstance which may be regarded as confirmatory of the greater biochemical efficiency of its digestive system, and as another evidence of its superiority in the scale of life.

Geological Distribution.—PLIOCENE.—In Suffolk, in the Forest Bed at West Runton, Mr. Clement Reid has discovered the *Helix hæsendoncki* of Nylander, which he regards as a synonym of the present species.

In Italy, *H. nemoralis* is cited by Dr. Thielens from the lacustrine limestone of Pliocene age at Monte Tignosa, near Leghorn.

HOLOCENE.—In Dorset, Mr. Clement Reid has recorded some large depressly-globular yellow bandless shells with dark lips from an early Neolithic kitchen-midden at Blashenwell.

In Buckinghamshire, it has been found by Mr. J. E. Cooper in the Alluvial brick-earth, etc., at Boveney.

In North Lincoln, at Greetwell, by Mr. J. F. Musham.

In Mid-west Yorkshire, Mr. J. Wilfrid Jackson has found it common in a Neolithic hill-wash at Clapdale, near Clapham.

In South-east Yorkshire, according to the Rev. E. P. Blackburn, it has been found by Mr. J. R. Mortimer in "barrows" of the Bronze age at Garbutt's Garton Slack; in Swinham Plantation, Aldro; at Birdsall Brow; at Wold Newton; at Lingwalk wood; in Esks road "barrow," Helperthorpe; and in Willie Howe's plantation.

Parasites.—The bee *Osmia bicolor* is said to utilize the empty shell of this species for its nest; while another insect *Sapyga punctata* inhabits the same shells and passes through two stages of its existence within the cells of the *Osmia*.

Variation.—M. Perroud has remarked that monochromic individuals are generally most numerous on the banks of rivers, especially in places liable to submersion in winter, and other continental observers have recorded that the yellow and fasciated varieties are very often found on *Inula spinosa*.

Mr. A. W. Stelfox has also remarked that the area inhabited by the var. *castanea* in Ireland is distinctly central and corresponds with the range of many other species of the central group.

M. Medoulé has found shells at Deville-les-Rouen and at Mont-Gardan, Seine Inférieure, possessing a sharply defined band, exactly at the sutural line, which he has proposed to distinguish as the “bande hyalo-perisuturale.”

Var. *pellucens* Moquin-Tandon (see p. 300).

Helix nemoralis var. *pellucida* Germain, Moll. Angers, 1903.

The sub-var. *pellucida* is described as of ordinary size, very fragile and pellucid, and almost transparent, usually of a yellow or rosy tint, but unbanded or with faint bands only, and with a somewhat thickened brown or maroon lip.

FRANCE.

Maine-et-Loire—On brambles by the city refuse-heaps near St. Nicholas Lake, Angers.

Var. *major* Férussac (see p. 296).

FRANCE.

In the Pyrénées, Dr. Germain states that this form ascends quite to the limit of perpetual snow, and is there of enormous size, with a diameter of 35 mill. and an altitude of 22 mill.; while Locard mentions specimens from Pyrénées Orientales 32 mill. by 29 mill., which Dr. Germain describes as forma *elata* when considered with reference to var. *major* of Férussac.

Var. *fasciata* Moquin-Tandon (see p. 310).

FRANCE.

Maine-et-Loire—Specimens of sexfasciate and septemfasciate shells are recorded as found in a hedge at St. Barthelmy, Angers, by Dr. Paul Germain.

Var. *lateritia* Dumont and Mortillet (see p. 314).

The sub-var. *roseozonata* of which a colony is recorded by Mr. A. W. Stelfox as existing on the boulder-clay cliffs with a southern aspect near the village of Curraun, West Mayo; they had the habit of resting beneath leaves of the Coltsfoot (*Tussilago farfara*), and probably feeding upon the orange-coloured fungus which infested the leaves of that plant.

Var. *albilabris* Dum. & Mort. (see p. 317).

AUSTRO-HUNGARY.

Bohemia—Although Herr Slavik records only *Helix hortensis* for Bohemia, his figures (pl. i., ff. 12, 13) of typical North Bohemian specimens seem clearly referable to the var. *libellula-albilabris*.

Var. *hyalozonata* Taylor (see p. 315).

Helix nemoralis var. *lucida* Caziot, Moll. Monaco, 1910, p. 80.

The sub-var. *lucida* is described as yellow and translucent, with bands semi-pellucid, and possessing an absolutely white peristome.

This variety does not accord with the var. *lurida* of Moquin-Tandon, as implied by M. Caziot, who apparently by error everywhere misspells the varietal name.

FRANCE.

Alpes Maritimes—Valley of the Tinée, between St. Sauveur and Clans (Caziot, l.c.).

Var. *umbilicata* Cockerell (see p. 296).

FRANCE.

Maine-et-Loire—Several found in the Cemetery of Pruniers near Angers, and recorded by Dr. Germain.

Helix hortensis Müller (see p. 326).

Geological Distribution.—In West Gloucestershire, it is recorded by Mr. H. Bolton from the Holocene deposits on Dumball Island.

In Mid-west Yorkshire, Mr. J. Wilfrid Jackson has found specimens of this species quite common in a Neolithic hill-wash at Clapdale, Clapham.

Variation.—When treating of this species in Part xviii. of the present work, I omitted any definite allocation of the *Helix hybrida* of Poiret from, amongst other reasons, the misleading name and the uncertainty of the true and precise character of the form.

That the uncertainty is not confined to this country is demonstrated by Dr. L. Germain, who in a recent work describes the *Helix hybrida* of Poiret as variable in colour, but generally fawn coloured, with a violet, white, or flesh coloured lip, and assigns it to *Helix nemoralis*.

I have recently been fortunate in acquiring a copy of Poiret's Coq. fluv. et terr., 1801, from which it is apparently clear that the *Helix hybrida* of that author (if correctly allocated to *H. hortensis*) is referable to my var. *lilacina* and not to the rosy-lipped unicolorous variety—var. *fusca*—with which it has usually been associated. If placed with *H. nemoralis*, as suggested by Dr. Germain and others, it must be associated with the var. *studeria* Moq. The description of Poiret is :—

Helix hybrida.—SHELL globose, imperforate, semitransparent, of a delicate lilac colour, with one or many bands; MOUTH without stain; LIP violet; WHORLS 5½. Diam. 16–18 mill. Inhabits large forests, Celle de Villers-Cotterêts, Aisne, Poiret, Coq. fluv. et terr., 1809, pp. 70, 71.

Var. fusca Poiret, Coq. fluv. et terr., 1801, pp. 70–73.

This name, which supersedes that of *baudonia* given by Moquin-Tandon, is also due to Poiret, and this form has hitherto also been overlooked or misunderstood. The var. *hybrida* has been in England almost invariably ascribed to shells undoubtedly really referable to var. *fusca*. This form is described by its author as

Helix fusca.—SHELL globose, imperforate, of a clear or dark fawn (faune noir); LIP distinct, brown or white, tinged with rose colour; MOUTH unstained; WHORLS 4½–5. Diam. 11–12 mill.

Var. A.—Shell of a pale yellow, greenish, or tinged with rose colour.

Var. B.—The same, with one to five brown spiral bands.

The great forests, Celle de Villers-Cotterêts, Aisne.

Var. lutea Picard, Moll. Somme, 1840 (see p. 345).

Helix hortensis var. *lutea-lurida* Swanton, Moll. Somerset, 1912, p. 32.

The sub-var. *lutea-lurida* of Swanton differs from that of Williams, being described as var. *lutea* blotched with faint lilac spots.

ENGLAND.

Somerset N.—Hedgebanks at Holbrook, near Wincanton, and on hilltops at Milton-Clevedon and Penselwood (Swanton, op. cit., p. 33).

Var. fascialba Taylor, var. nov. (pl. xxviii.).

The var. *fascialba* is characterized by the presence of a white and calcified suprapерipheral zone, upon which the third band of the pentatæniate formula is placed.

The specimen upon which this variety is based is of a slightly greenish-yellow colour, with the supra-peripheral white zone, and has the formula 00300.

ENGLAND.

Somerset N.—Blagdon near Bristol, Miss F. M. Hele (Darbshire Collection, Manchester Museum).

Var. ludoviciana Moquin-Tandon (see p. 341).*Helix hortensis* var. *cornea* Germain, Moll. Angers, 1903, p. 94.

The sub-var. **cornea** is described as of ordinary size, extremely thin and transparent, of a bright and uniform golden-yellow, or occasionally whitish or rose coloured, with the characteristic striations of a clearer colour than the rest of the shell, lip thick and pure white.

FRANCE.

Maine-et-Loire—Rare on nettles by Lake of St. Nicholas, Angers.

Var. fuscolabiata Kreglinger (see p. 358).**AUSTRO-HUNGARY.**

Bohemia—Recorded from near Reichenberg by Herr Slavik.

SUB-GENUS *Euparypha* Hartmann (see p. 368).

Classification.—Comm. Caziot has constituted a group *Pisanana* to embrace *Helix pisana* and species which he regards as closely allied thereto.

Helix pisana Müller (see p. 368).

Origin.—*Helix pisana* is considered by Dr. Scharff to have originated in the Lusitanian region, and to have reached this country from the South-west, but the recent discovery by Dr. Bouly de Lesdain of this species in the Pleistocene deposits of the extreme North-east of France do not support this contention.

Reproduction and Development.—The amours of this species in Sicily, according to Signor T. de Stefani, commence in September and October, immediately on the advent of the autumn rains, which terminate their summer æstivation, and at which period numbers of individuals can be seen wandering about, seeking their prospective partners. Conjugation is, as in many other species, preceded by many amorous acts, the anterior part of the foot of each animal being raised and closely appressed to that of its mate, while they mutually caress each other with their tentacles, and indulge in many other endearing blandishments.

During the act of congress the animals are partially retracted within their shells, and if disturbed retire still further inside, so that the mouths of the two shells are brought into close apposition; the connection usually continues for about two hours, and never for so long a period as a day or more, as has been stated by some authors.

In from one to four days after pairing, the snails commence egg deposition, unless a dry period intervenes, when the process may be delayed for many days. Under favourable circumstances the deposition occupies an entire day, the snail choosing a convenient and moist place, a hedge-bottom being preferred, and excavating a nidus therein, which is usually about $4\frac{1}{2}$ mill. in diameter and 13 mill. in depth. This excavation is accomplished by the mollusk gradually insinuating its body into the earth, until the required depth has been attained, the displaced earth becoming piled around the margins.

The eggs are perfectly spherical in form, about a millimetre in diameter, of a slightly violaceous white, with a mucilaginous investment, and though usually fifty or sixty in number, there may be occasionally as many as ninety, which are generally deposited in a little heap in one nest. When the deposition is completed, the snail covers the eggs with earth, forming a little mound, which to the experienced eye reveals the site of the nest.

The eggs hatch in about 12–17 days, according to temperature, but the tiny snails do not then disperse and abandon their nidus, but for a period congregate together and form a colony in its immediate vicinity.

Food and Habits.—In Sicily, according to T. de Stefani, this species not only feeds upon a great variety of plants, but also devours the fruit of the Indian figs (*Cactus opuntia* and *C. tuna*), which are regarded as quite inedible.

The summer aestivation is not carried out buried in the soil, or secreted in chinks and crevices, but attached to various erect supports, as dried stalks, tree trunks, etc., and always in positions fully exposed to the sun.

The highest altitude attained by *Helix pisana* in France or in Corsica is said by Comm. Caziot not to exceed 2,500 feet.

Enemies.—In Sicily, T. de Stefani has observed that the hedgehog, the crows, the magpies, and the owls prey upon this species, the owls especially showing a preference for and freely devouring them. Amongst the Coleoptera, the *Carabids* and *Lampyrids* are also great enemies, while *Testucella* is said to devour the newly-hatched young.

Geological Distribution.—Comm. Caziot records it as found rarely in the post-tertiary clays which form the sub-soil about Nice, but states that it has never been detected in the “bone-beds” of Menton.

Geographical Distribution.—Prof. Nobre records its occurrence on S. Thiago and Santo Antao, Cape Verde Islands, on the authority of M. Cessac.

Variation.—The *Helix pisana* now so abundant near Paris have quite lost their fasciation, a circumstance which Dr. L. Germain quotes as illustrating the suggested rule that species introduced into a new locality tend to lose their normal banding.

Var. *globosior* Shuttleworth (see p. 377).

Helix pisana var. *laghetensis* Caziot, Moll. terr. et fluv. Monaco, 1910, p. 281, pl. 1, f. 4.

The sub-var. *laghetensis* is described as shell very globose, conoid, spire much risen, solid, subopaque, milky white, very finely striate, six whorls, rapidly increasing in size; suture deep, the last subcarinate; mouth rounded.

Altitude 20 mill.; diameter 22 mill.

It is very close to the var. *donnelli* of Pallary (figured and described at p. 378), and is found on the coast of the Alpes Maritimes from Menton, Monaco, to Théoule and to Trayas, where it lives on porphyritic rock.

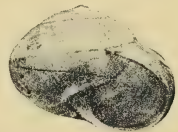


FIG. 554.—*H. pisana* var. *laghetensis* Caziot. Alpes Maritimes (after Caziot).

Var. *minor* Bourguignat (see p. 383).

FRANCE.

A var. *minor*, according to Comm. Caziot, is found in the Alpes Maritimes at Napoule, between Cannes and Théoule on the banks of the Var, near its mouth.

ITALY.

Tuscany—Found at Siena by Dr. Guebhard and recorded by Comm. Caziot.

Helicigona lapicida (L.) (see p. 399).

Parasites.—*Agamonematodon hospes*, a Nematohelminth, is found in *Helicigona lapicida*, according to Dr. von Linstow.

Geological Distribution.—Mr. J. F. Musham has found this shell in the Holocene deposits at Greetwell Iron Mines, North Lincoln.

Geographical Distribution.—The correctness of the statement by Dr. Leach and others (see p. 415) of its presence in the South of Ireland has been confirmed by Mr. E. Dukinfield Jones, of Reigate, who found specimens at Carrig-a-brick Castle, near Fermoy, co. Cork, forty-two years ago, the specimens being now deposited in the National Museum, Dublin. The accuracy of this record has been recently verified by Mr. R. A. Phillips, of Ashburton, Cork, who on being informed of the locality, visited the spot on Nov. 8th, 1913, and after a short search found three living and two dead shells under stones by a wall on the margin of the wood near the castle, associated with *Hyalinia cellaria*, *H. lucida*, *Arion hortensis*, *A. intermedius*, *Hygromia rufescens*, *H. hispida*, *Pupa cylindracea*, and *Clausilia bidentata*.

The occurrence of this species, so far removed from any of its known haunts, must in the present state of our knowledge, inevitably lead us to the conclusion that they are the descendants of individuals artificially introduced in the past by accident or design.

In Denmark, Dr. Steenberg says it is widely distributed and common.

Variation.—Dr. Westerlund has remarked upon a dichroic variety of this species from the mountains of Gottsunda, near Upsala, Sweden, which he described as horn-coloured above and bluish-white below, which may be termed var. *bicolor*.

Var. *ecarinata* Schmidt (see p. 406).

Helix lapicida var. *guyardi* Caziot, Moll. terr. et fluv. Yonne, 1908, p. 209, pl. 1, ff. 18-24.

The sub-var. *guyardi* differs from the type in its lesser diameter, greater convexity, or more conoidal shape above, and its deeper suture; the whorls are sub-convex or less flattened, last whorl less deflected, and the mouth rounded, but not exactly circular, like in *H. andorrica* Bourg. Diam. 14 mill.; alt. $8\frac{1}{2}$ mill.

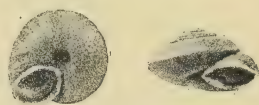


FIG. 555.—*Helix lapicida* var. *guyardi* Caziot. Yonne, France (after Caziot).

FRANCE.

La Pierre-qui-Vire, Yonne (Caziot, Moll. Yonne, 1908, p. 209).

Var. *albina* Menke (see p. 408).

FRANCE.

Recorded from Vontenay, Yonne, by Comm. Caziot (Moll. Yonne, 1908, p. 209).

Var. *fasciata* Taylor (see p. 409).

FRANCE.

The sub-var. *infrafasciata* is represented in the British Museum by a specimen from Grasse, Alpes Maritimes, collected by Mr. G. Newman.

Var. **minor** Moquin-Tandon (see p. 407).

FRANCE.

Comm. Caziot reports the occurrence of this variety at La Pierre-qui-Vire, in the department of the Yonne.

Var. **radiata** Gassies (see p. 410).

SPAIN.

Mr. Jolliffe reports from Catalonia the sub-var. *flammulata* of Dupuy; and the sub-var. *fulva* is recorded from Voutenay, Yonne, by Comm. Caziot.

Helicigona arbustorum (L.) (see p. 417).

Origin.—Dr. P. Germain is of opinion that *Helicigona arbustorum* is a species of undeniably Alpine origin, and in confirmation of this view remarks that it is still rarer in the plains than on montane or submontane regions; but as pointed out (p. 443) *H. arbustorum* is a subdominant species, and has been expelled from the more favourable districts, and is now chiefly found on the less desirable marshy or low-lying lands, or in mountainous regions, and is not common in the intervening more favourable country.

Physiology and Food.—Mr. R. Welch, who has kept this and other species in confinement, has observed that *H. arbustorum* has a great capacity for food, devouring many times the amount consumed by *Helix nemoralis*, and therefore, as I would observe, be less able to resist privation in times of stress.

Habits.—Prof. A. E. Boycott reports that in the Forest of Dean, where this species is very plentiful, he has observed in July great numbers of immature shells, adherent to the vegetation or other objects, fully exposed to the hot mid-day sun.

Geological Distribution.—PLEISTOCENE.—In France, it is recorded by Dr. Germain from the quaternary beds of Pas-de-Calais; in the tufa of St. Pierre lès Elbeuf, Seine Inférieure; and of Buisse, Isère; in the lacustrine marls of the Rhône Valley, Lyons; and in the loess of Bas-Rhin, Alsace, Jura, Rhône, Ardèche, and Dauphiny.

In Belgium, it was found in the tufa of La Sauvage, in the Grand Duchy of Luxembourg, by Bleicher and Fliche.

HOLOCENE.—Mr. J. Wilfrid Jackson has found *H. arbustorum* commonly in a Neolithic hill-wash in Clapdale, near Clapham, Mid-west Yorkshire.

Geographical Distribution.—

ENGLAND.

Norfolk W.—Mr. W. Royal-Dawson found this species at Sedgford in 1906!

FRANCE.

Dr. P. Germain states that though this species has been observed in nearly every department, it is more especially found in the centre and east of the country.

NEARCTIC REGION.

Newfoundland—Recorded by Mr. Whiteaves as introduced in the neighbourhood of St. John.

Variation.—Dr. P. Germain, who has especially studied the effect of environment upon shell form, affirms that *H. arbustorum* and other species when living under exceptionally humid conditions become remarkable for the slow coiling of their shells, and by the compression of the last whorl, and infers from the presence of these characters in the fossil specimens of *H. arbustorum* from the various Pleistocene deposits of the south of France that the locality they inhabited was of a very humid character.

Dr. Germain has described and figured (Archiv. Nat. Hist. Mus. Lyons, 1912, pp. 72 and 166–170, pl. iv., f. 148) a new variety of this species, which is said to be remarkable for its very depressed form, thick, solid, and somewhat cretaceous shell, which is finely striate as in var. *minor* Locard, and has a very narrow supra-carinal brown band.

He also notes from the deposits about Lyons three distinct forms of this species, which he differentiates as *major* Locard, *intermedia* Germain, and *minor* Locard.

The sub-var. *minor* Locard has a diameter of 14–16 mill., and an altitude of 11–12 mill., and was common about Lyons at the time of the deposition of the loess, becoming successively modified into the vars. *intermedia* and *major* as the conditions became less rigorous, the var. *major* being now the typical form of the present day about Lyons.

The sub-var. *intermedia* Germain is 19–20 mill. diameter, and 15–16 mill. in altitude, thick, quite solid, and somewhat heavy, with a globosely-elevated form. Dr. Gaillard found specimens in the loess at L'Île Barbe, St. Rambert, Rhône, and at Bégude, in the commune of Feyzin, Isère.

The sub-var. *major* Locard, from the tufa of Buisse, Isère, is 22–23½ mill. in diameter and 16–17½ mill. in altitude, and is the form now occupying the plains, and is rare about Lyons.

Var. *canigonensis* Boubée (see p. 440).

Helix arbustorum var. *doriæ* Paulucci, Faune Mal. Italie, 1878, p. 31.

The sub-var. *doriæ* is described as possessing a shell of an uniformly dark olive-green colour, completely destitute of the characteristic marblings, but sometimes showing a slightly perceptible supra-peripheral band.

ITALY.

Piedmont—Found by the Marquis Doria on Mont Barone near Biella (Paulucci, Faune Mal. Italie, 1878, p. 31).

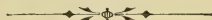
Var. *gaillardi* Germain.

Helix arbustorum var. *gaillardi* Germain, Moll. terr. et fluv. quatern des bassins du Rhone et du Rhin. Archiv. Mus. Hist. Nat., 1912, p. 72, pl. iv., ff. 148, 166–170.

SHELL size of var. *minor* Locard, but much more depressed, spire little risen, whorls six, convex, regularly increasing in size, and separated by a well-marked suture, last whorl noticeably more convex below than above, and deflected at the mouth; mouth transversely oval and quite oblique, reflected over the umbilicus, which it almost entirely covers; peristome thickened and reflected.

Diam. max 15 mill., min. 13 mill.; alt. 9 mill.; diam. of apert. 8 mill., alt. 7 mill.

Discovered in the loess of L'Île Barbe, St. Rambert, near Lyons, by Dr. Cl. Gaillard, to whom the form is dedicated.



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 CORRIGENDA.

- Page 59.—Fig. 91 should be described as Nerve-ring of *H. alliaria*, not *H. helvetica*.
 Page 73.—Five lines from bottom, Hants. N. should be Northampton.
 Page 132.—Bottom line, Tepec erroneously indicated as in Lower California.
 Page 171.—The radula of *P. rupestris* (Fig. 227) if correctly identified, is evidently from an abnormal animal; therefore, a figure from a more normal shell is given. Mr. Bowell first directed my attention to its misleading character.



FIG. 556.—Half-a-transverse row of the teeth of *Pyramidula rupestris*, highly magnified, Grange (from a photograph by Mr. W. Bagshaw of a preparation by Prof. H. M. Gwatkin).

The formula is $\frac{11}{3-6} + \frac{8}{2} + \frac{1}{1} + \frac{8}{2} + \frac{11}{3-6} \times 180 = 7,020$.

- Page 232.—King's Lynn should be allotted to West Norfolk, not to East Norfolk.
 Page 293.—Six lines from bottom, the formula 123(05) should be (123)05.
 Page 294.—Twelfth line, the formula 10045 should be 100(45).
 Page 299.—Twenty-second line, the record of *H. nemoralis* place with *H. aspersa*.
 Page 308.—Thirty-third line, Monaghan is used in error for Co. Meath.
 Page 404.—Seventeenth line from bottom, South Essex should read West Kent.

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